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No. 40

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NATIONAL DEVELOPMENTS

ROLE OF RESEARCH PLANNING, PERSONAL FREEDOM DISCUSSED

Beijing RENMIN RIBAO in Chinese 5 Apr 80 p 3

[Article by Gu Yan [6253 6056]: "Planning and Freedom for Scientific Research"]

[Text] After having read the article "How to Regard Such Scientific Technicians" in RENMIN RIBAO, I would like to present some views on the relation between planning for scientific research and personal freedom in scientific research.

In the realm of economics, and as can be seen through practice and examination, everything that smacks of "freedom," such as self-retained land, free markets, and independent accounting, is supposed to be contaminated by capitalist ideology or is refuted. The solution of such a question brings forth mass activism and raises the level of economic development.

However, in the realm of science, everything that smacks of "freedom" still draws criticism. An example of this is the unsympathetic attitude and oppression met with by Comrade Zhang Kaixun [1728 7030 6676] in his view on "personal freedom in research."

It is reasonable that the freedom to choose one's research topic should be greater in the realm of science than in other areas. This matter has not been resolved because the penalty is not as direct or obvious as it is in other areas.

Independent Thinking is Necessary in Scientific Research

The purpose of scientific research, especially in basic research, is to ascertain the unknown. This means that it is difficult to regulate when and with what purpose it should be carried out. The research on relativity was not aimed at the production of atom bombs, but its results led to the application of nuclear fission. The current research on particles, including research on the conjecture of Gedebahe [0766 1795 1572 6378], cannot be considered of relevance to direct application. We cannot tell when we will discover new particles, or when we will resolve the conjecture of Gedebahe.

Do we advocate aimlessness in research? No. There is a goal even in basic research, which is to ascertain the unknown, to obtain new knowledge, and to understand the objective regularities of matter. Even research whose applicability is relatively obvious faces many uncertainties in terms of reaching its predicted goals and the selection of means and methods.

In the history of scientific research, many important discoveries involve an element of serendipity, such as Roentgen's discovery of X rays, Fleming's discovery of penicillin, and so on. In this case, the imaginative power of scientists and their inventive faculty depend on their interests and concentration.

In the realm of science, solving problems is certainly important, but raising questions is even more important. The development of new ideas, viewpoints, and assumptions is generally a mark of progress and development. Einstein said: "It is generally more important to raise a question than to solve a problem, for the latter may merely be an exercise in mathematics or experimentation. Hence, we must fully treasure the spirit of creativity, and at no time should we strangle freedom in scientific thinking and investigation."

During the tyrannical reign of Lin Biao and the "gang of four," scientific research met with disasters because personal interests and independent thinking were denied. Today, though Lin Biao and the "gang of four" have been smashed, some comrades who do not understand scientific development have caused oppression and loss of talents, a condition which we must pay attention to.

The Purpose of Planning

The freedom to think is very important in scientific research. Of course, this does not mean that we have no need for planning. We should promote the superiority of planned developemnt in the socialist system. But socialism and planning are not exactly equivalent; planning is not all that socialism stands for. The purposes of what we call planning in scientific research are as follows:

1. Point out the direction of scientific research based on the needs of the society.

2. Determine priorities and schedules based on comprehensive assessment and our personnel, financial, and material resources.

3. Avoid repetition and wastefulness by coordinating efforts in various departments.

Obviously, the objective of planning is to better serve the needs of the society, coordinate and organize the activism of various departments, encourage creativity, and guarantee progress in scientific research.

How are plans for scientific research made? The main area is to ascertain the needs of the society based on the national plan. Part of it, however, is based on assignments to scientific institutes from relevant units. This is done through contracts and discussions, a means of decentralized planning. We have a need to develop this form of production in view of the objective conditions in our country. Part of planning is based on the developmental trends in scientific research as recognized by scientists. After the review of specialists in the field, and permission granted by the supervisory department, research topics can become part of a plan. Each topic should retain its autonomy, but change is still possible. If the original topic proves to be impracticable, it has to be revised. Or, if not, it can be altered when new assumptions and ideas come along.

Large Projects and Small Freedoms

Plans do not encompass everything. Small freedoms should be allowed in large projects. Topics which require thorough investigation should be given support as related research as long as they have a sound scientific basis, even though no result can be made known within a certain time frame. After the period of investigation and after open discussions, decisions can be made on whether they should be included as part of a project. These research topics which at first are considered of peripheral interest to a project often bear significant meaning. Many initial questions in science and technology are often unexpected, or they are not planned in advance, but are gradually included in the overall plan.

We should not interfere with part-time research conducted by scientists such as Comrade Zhang Kaixun, but rather we should give it support, encouragement, and guidance. Just to quote yet another remark of Einstein: "The daily life of an ordinary citizen does not rely on special wisdom. If he is interested in science, he can devote himself to the problems that intrigue him after work. He does not have to worry that his efforts will bear no fruit." Einstein did his work in that manner. Part-time research often produces unexpected results.

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NATIONAL DEVELOPMENTS

PRESENT STATE, FUTURE PROSPECTS OF GEOTHERMAL EXPLORATION REVIEWED

Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 22, No 4 Oct 79 pp 383-385

[Article by Wei Siyu [7614 2448 4416] of the Institute of Geophysics, Chinese Academy of Sciences, Dong Wei [0157 0251] of Beijing University, Wang Jiyang [3076 7162 2543] of the Institute of Geology, Chinese Academy of Sciences, and Zhang Mingtao [4545 6900 7118] of the Comprehensive Investigation Committee, Chinese Academy of Sciences: "Present State and Future Prospect of Geothermal Investigations in China"]

[Text] Abstract

This paper discusses the distribution of geothermal activities in China in relation to tectonic structures. Prospecting of geothermal resources and their utilization and the present state of theoretical, observational and experimental work in geothermic studies are reviewed. Finally, the article looks into the future tasks and the prospects of geothermic research in this country.

I. Introduction

Geothermics is one of the classical geophysics sciences. Globally speaking, this was a very weak area of research in the past, which is primarily attributed to the fact that subterranean heat flow fields are controlled by man factors, plus the limitations imposed on geothermic measurements by such observational conditions as drill holes, mineral wells, etc. But, as geothermics is an indispensable link in learning about the earth, and due to the birth of the tectonic plate theory, plus the need for energy sources and means of preventing heat calamiyies, extensive interest in geothermic research has developed in recent years. In the late 1960's, China's late geologist Professor Li Siguang [2621 0934 0342] had already come up with the idea of utilizing geothermic energy. It was not until the early 1970's when the whole country began to conduct extensive general surveys on geothermic resources; Beijing, Tianjin, Sian and other major cities began to explore for underground hot water in an effort to meet the demands for heating, and industrial and agricultural heat sources. In addition, pilot geothermic electric power stations were constructed in Guangdong's Fengshun and Hebei's Huailai. In recent years, the State Geological Bureau, Beijing University, and the Comprehensive Investigation Committee of the Chinese Academy of Sciences pooled their efforts in a massive scientific investigation on the distribution and classification of geothermic resources and hotsprings in Xizang.

In recent years, the State Geological Bureau and the Ministry of Water Conservancy and Electric Power have showed much concern for geothermic work in our country, and sponsored many specialized symposiums on geothermics. In December 1978, the Chinese Academy of Sciences held its first National Geothermic Academic Forum in Guangzhou, which was a very important step in accelerating geothermic research in China.

II. Present State of China's Geothermic Research

As terrestrial heat appears to be interrelated with geological structures as well as mineral mining, geothermic research in China was initiated by the Ministry of Geology in the 1960's.

For quite a few years, general surveys and explorations in quest of subterranean hot water were conducted by the Institute of Hydrogeology and Engineering Geology of the State Geological Bureau, Beijing University, and concerned organizations in various provinces and cities. According to incomplete statistics, our country has already discovered hot springs in some 2,500 locations. Most of them are distributed in our country's Taiwan Province, and the southeast coastal provinces of Guangdong, Fujian and Jiangxi, located in approximately 500-odd places; most of the hot springs have high temperatures well over 60 degrees Centigrade, and some can reach about 100 degrees Centigrade. Next, Yunnan Province's hot springs are distributed in approximately 482 locations mostly in the vicinity of Lake Dianchi, north and south of Lake Erhai, as well as in the drainage areas of Satuahe and Nujiang rivers where the water temperatures are over 40-50 degrees Centigrade. In Lake Cianxi, the famous Tengchong Volcanic Mountain Hot Spring Region has altogether 70-odd springs, the water temperatures of which are as high as approximately 98 degrees Centigrade. Other relatively densely distributed hot spring areas include Liaodong Peninsula, Shandong Peninsula, Yanshan Mountain Region, etc.

Quite a number of hot springs have been found in China's Taihang Mountain, Lüliang Mountain, Weihe River Valley and the eastern part of Qinlin Mountain; the water temperatures average 41-62 degrees Centigrade. For instance, in Lintong County, the water temperature of the Huaqing Pond is 51 degrees Centigrade; along the northern bank of Jinge'er in Kunlun Mountain, there are 50-odd hot spring locations. Hotsprings are also distributed along Tianshan Mountain's Beilu; in Sichuan Basin, there are some 20 hot spring cities; rich deposits of sub-surface thermal water have been discovered in Tarim Basin.

According to information provided by the Qinghai-Xizang Plateau Comprehensive Scientific Survey Team of the Chinese Academy of Sciences, there are extremely rich geothermic resources in China's Qinghai-Xizang Plateau; the geothermic manifestations are extremely evident, and various kinds of high temperature hot springs are found there, including fumaroles, geysers and even hydrothermal explosions, etc. The hydrothermal activities are even more violent on the northern and southern sides of the midstream portion of the Yarlung Zangho River where a wet-stream field, known as the Yangbajing Field, is currently under exploration, and the highest temperature ever measured is 170 degrees Centigrade. At present, efforts are being made to plot a hot spring distribution map of the whole country based on the preceding hydrothermal exploration results.

By the 1970's, more attention was attached to the exploration of geothermic resources. Subterranean hot water general surveys and prospecting work were conducted in some 20 provinces, cities and autonomous regions. To map out the distribution scopes of subterranean heat resources and determine their coverage thickness, the relief of blind bed rocks and the locations of thermal resources, various methods such as geology, temperature measurement and geophysical prospecting were used in combination with drilling engineering.

The employment of geophysical exploration method for the prespecting of geothermic resources began in the 1960's. For example, the thermal resources in Hunan Province's Ningxiang Huitang, Beijing's Xiaotangshan and Shanxi Province were all discovered through the application of the electrical surveying method. Magnetic prospecting was another method used in termal resources exploration, which proved that the range of magnetic anomaly was basically in agreement with the distribution of subsurface hot water.

Besides, our country has now successfully developed an infrared multispectrographical scanner probing system. Infrared technique and airborne remote sensing method have been used in experiments and measurement projects in certain areas with excellent results.

On the basis of the prospecting results, the utilization of subterranean hot water is extensively developed in various parts of the whole country, especially in Beijing, Tianjin, Shandong, Guangdong, Hebei and various parts of northeast China where subsurface hot water is not only used in industry, agriculture and medicine, but also in comprehensive applications.

In 1970, our country's first geothermic pilot station was completed and set into operational mode in Guangdong's Fengshun Dengmu Region. In 1971, a small geothermic pilot station was set up in Beijing's Huilai. Recently, Xizang's Yangbajan Region constructed a geothermic electric power station.

With the development of industry and the ever increasing depth of mineral mining, the heat damage problem has been put on the agenda; our country's current mineral mining depth has reached 500-600 meters, and can even reach as deep as 1,000 meters, which has not only brought difficulties to mining, but also impaired the health of the miners. In this aspect, the Ministry of Metallurgical Industry, Ministry of Coal Industry and other concerned organizations attach great importance to the investigation and prevention of heat damage. At present, they have set up bases in Hebei's Tangshan Kailuan Coal Mine, Henan's Pingdingshan Mine, Shandon's Yanzhou Coal Field, Dongtanjing Field, and Anhui's Luohe Iron Mine. Comparatively systematic geothermic tests and research are conducted in mines, and some significant results have been achieved.

The geothermal current is a physical quantity which reflects the internal heat status of the earth. All countries attach great importance to the observation and study of this particular physical quantity. By the end of 1975, the whole world had a total of 5,417 thermal current data (2), of which the sea data numbered six times more than land, which revealed the heat field distribution of the entire globe. Our country has now disclosed the first batch of thermal current data, totaling 18, which had been obtained from thermal current measurement projects in north China and neighboring areas.

Heat flow data gathered in north China indicate that in the North China Plateau, there is a wide area of exposed upwarped ancient bed rocks where the heat flow value is 0.8-1.3 x 10^{-6} calories per cm^2.sec, averaging 1.1 x 10^{-6} calories per cm^2.sec, which is near the normal value of this type of geological unit. The heat flow value of the Cainozoic great depression zone in north China's plateau is 1.5-1.9 x 10^{-6} calories per cm^2.sec, averaging about 1.7 x 10^{-6} calories per cm^2.sec; it is apparantly a high heat flow area. In the early Palaeozoic quasifolded strata zone of the Yanzi-Qiantang region, the mean heat flow value is 1.84 x 10^{-6} calories per cm^2.sec, which is also higher than the mean value of the same type of zone. The heat flow value discrepancy reflects the disparity of stability among the geological structures of the various zones, which correlate with the crustal structures, radioactive material contents, and upper mantle temperature in this area.

The Institute of Geology, Chinese Academy of Sciences has obtained oil well temperature data from the Ministry of Petroleum Industry. Moreover, on the basis of temperature measurement data gathered from 200-odd drilling holes in north China, it has compiled a 300-meter depth geothermal status chart of the North China Plateau, and the mean geothermal gradient chart covering this range (1), thus creating an excellent beginning for China's research in this aspect.

With the development of earthquake forecasting work, especially in the wake of the great Tangshan earthquake in 1976, we have begun to probe into the relationship between terrestrial heat and earthquakes.

In addition, in geothermic and plate tectonic theories, some efforts have been made to study such problems as mantle pouring, upper mantle convection (3), magmatic upsurge, etc., and there are also developments in mathematical assimilation and some heat parameter tests (e.g. heat conductivity, density).

In sum, our country has conducted many investigations on geothermic resources, and has just begun to tap the heat resources, adopt preventive and remedial measures against heat damage and injuries, and conduct research on geothermic theories. Geothermic theoretic research is still a weak area in this country, and there is very little heat flow data to go on. In order to build a prosperous and strong country, we must properly and effectively utilize the rich geothermic resources. There is a great deal of hard work to be done in geothermics, but great prospects await ahead.

III. Future Tasks and Prospects

Geothermics is basic theory research in earth sciences, and plays a major role in the research on plate tectonics, laws of mineral formation and mineral resources exploration, earthquake genesis and prediction, utilization of geothermal resources, prevention, control and prediction of heat damages, as well as medicine, industry and agriculture. Our country has made certain achievements in geothermics and will go all out in laying the foundations for research in this area.

Of course, our country's geothermic workers still face an arduous task ahead. There must be a unified plan for geothermic work. Within a short period of time, we must investigate the distribution patterns of geothermic resources in this country, and study the formation mechanisms and control conditions of geothermic fields. As our country started geothermic research rather late, it is imperative to step up such work as measuring terrestrial heat flows and obtaining large amounts of information and data. Geothermic test well networks must be set up in major tectonic activity areas, which can provide information on heat field characteristics and the earth's internal heat status. This is of far reaching significance to such projects as learning about the thermal structure of the earth's crust and upper mantle in certain typical areas of our country, understanding the temperature distribution inside the earth, probing into some major problems in earth sciences (e.g. the driving mechanism of plate tectonic movement, mantle convection, mantle heat column, and the genesis, growth and evolution of upper mantle magmatic sources, geothermic indications of crustal activity, the relationship between the migration of crustal high temperature zones in geological age and geotectonics).

Thus, the strengthening of geothermic basic theory research and the study of applications which can serve the national economy are an important link in the development of geothermics. Therefore, it is not only imperative to combine them with crustal-upper mantle research and conduct comprehensive research on the geophysical field, but also to futher improve and enhance the instruments, equipment and testing systems used in geothermic well-bottom observation, parameter determination in the laboratory, and large area geothermic general survey. Moreover, it is necessary to introduce modern science and techniques into this realm, and closely combine geothermic research with production. This is the only way we can make geothermics--a classical science--radiate the vigor of youth in the research on today's earth crust and upper mantle, and make a glorious contribution to our motherland's four modernizations program.

Bibliography

1. Chinese Academy of Sciences Geology Institute Geothermal Department, Geothermal Research Papers, 1978.

2. Jessop, A.M., Hobart, M.A. and Sclater, J.G., the World Heat Flow Date Collection, 1975, Geothermal Service of Canada, Geothermal Series No 5, Ottawa, Canada, 1976.

3. Li Yinting [2621 5593 0080] and Guan Dezha [7070 1795 8546], "Undersea Expansion Drive Mechanism" ZHONGGUO KEXUE [SCIENTIA SINICA], Vol 3, 1979.

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PHYSICAL SCIENCES

CHARACTERISTICS OF EVOLUTION OF PETROLEUM IN HUANGHUA DEPRESSION

Beijing SHIYOU XUEBAO [ACTA PETROLEI SINICA] in Chinese Vol 1, No 1, Jan 80 pp 43-51

[Article by Wang Benshan [3076 2606 0810], Liu Dehan [0491 1795 3352], Zhang Lijie [1728 7787 3381], Li Zhaoping [2621 2507 1627] and Shao Wenlan [6730 2429 5695] of the Guiyang Geochemistry Institute of the Chinese Academy of Sciences: "The Characteristics of the Evolution of Petroleum of the Huanghua Depression in the Bay of Bohai and Simulation Study"]

[Text] In recent years, as the cheese base theory of petroleum genesis developed, people have given a lot of attention to the evolution of petroleum (i.e., the genesis, development, oxidation and alteration). Various scholars have conducted broad studies in different regions.(1-7) They have made great progress in the classification of the evolutionary stages of petroleum, determination of the critical temperatures of each stage and changes in the characteristics of composition of crude oils, and they have preliminarily established a model of the evolution of petroleum. But the above studies mostly emphasize environments of marine facies and delta facies in the genesis of petroleum. Few have studied the genesis of petroleum in a basin of land facies characteristic of our nation. This article is an attempt to explore the evolutionary characteristic of petroleum in the Huanghua Depression of the Bay of Bohai Basin on the basis of an anatomy of the typical sections and in combination with artificial simulation experiments.

1. Geological Background

The basin of the Bay of Bohai is situated on the eastern part of the North China mesa. The Huanghua Depression is a downthrown fault of the graben type composed of a series of persistently active normal faults. The faults inside the depression are very developed and are all normal faults. During most of the period of development of the depression, most of it was an underwater basin under supplementary conditions. The rate of sinking was fast and the basin contained between 4,000 and 5,000 meters (8,000 meters at the thickest place) of sediments of the Tertiary. Even though a discontinuity occurred in the sedimentation between the upper Tertiary and the lower Tertiary, denudation over a large area did not occur except for the ridges of Heilongcun and Kongdian. Therefore, the process of geological development of this depression is characterized by sinking. The present depth of burial of sediments may very possibly represent the maximum depth reached during the course of the depression's geological history. Most of the faults were continuously active during the upper Tertiary and sometimes the activity even extended into the lower Tertiary, causing extremely uneven sinking amplitudes of each section in the depression. Thus, often during the same period, the same sedimentary layer formed similar sedimentary cycles. These sedimentary layers were separately buried under different depths and were affected by different temperatures and pressures of earth strata.

To study the evolutionary characteristics of petroleum under different temperatures and pressures and at the same time to consider limiting as much as possible the interference created by the differences in such factors as the sedimentary environment and catalytic conditions of inorganic minerals, the writer has selected the stable key layer of the central part (Es_I^{middle}) of section I of the Shahejie group of the Tertiary under the Dagang Oilfield as the subject of study. The layer is not thick but its area is wide. It is distributed in the oil producing region as well as regions of future prospecting. Its lithic nature consists of grayish brown lined mudstone. Its inorganic composition is mainly of clay minerals. It contains ash and very small traces of quartz (powdery sand) and such clastic materials. Most of the clay minerals are illite and are relatively uniform. In addition, there is a considerable amount of scattered microcrystalline pyrite. Its content of organic components is relatively high (about 5 to 8 percent). There is more sapropelic organic matter than humic organic clastolite. The sample from the shallow part shows portions of gelatinated woody structures and it also contains relatively coarse organic pieces of the lipoid group. The mudstone of this layer is characterized by a rich storage of fossils of mussel-shrimps (often called sesame cake type mudstone because of its shape). Most of the mussel-shrimps have become calcite. Analysis of the lithic nature, structural tectonics, paleontological life and the characteristics of the composition of organic matter shows that the sedimentary environment of various localities was not too different when this layer underwent sedimentation. The composition and content of inorganic minerals are more similar. But because of the activity of the faults after the sedimentary period, the layer was buried under different depths. In general the southwestern part of the oilfield is shallower, within a range of between 1,500 and 1,800 meters deep. The northeastern part visibly deepens to a depth of more than 2,000 meters. Actually measured data obtained from drilling show that the present temperature gradient of this area is 34°C/1000 meters. To clearly see the effects of temperature and pressure of the strata upon the evolution of petroleum, the writer studied the core of Es_I^{middle} of each of the wells NK_{32} (1,477 meters), B_{22}(2,519 meters), G_{26}(2,871 meters) and NG_{57}(3,478 meters).

II. Method of Study and Results

1. Studying the Organic Matter in Rocks by Microscope

The study of organic matter by microscope involves the study of the structural characteristics, distribution and other petrological characteristics of organic matter in flakes or smooth surfaces of rocks under the microscope without destroying the characteristics of the outer form of organic granules. A comparative study of the core samples of the four Es_1 middle layers of different depths shows the following:

(1) In all samples, the organic matter is composed of sapropelic matter of lower animals and humified pieces of higher land plants. Humus that typically characterizes the causes of land facies-sapropelic organic matter is present.

(2) As the depth of burial increases, the glassy coal structure in the rocks gradually becomes defective and obscure and finally disappears. Organic pieces of the lipoid group also disappear gradually. The relative content of sapropelic material also lessens. Corresponding to this, the color of gelatinated organic granules changes from light reddish brown to dark brownish drab. The color of fluorescence changes from a weak yellowish brown to dark brown (at the shallow part, pieces of spores emitting blue gray fluorescence can be seen). The reflectance (R°) also increases from 0.29 to above 1 gradually (Table 1).

Table 1. Results of H/C Analysis of $C_{organic}$ Rocks and Characteristics of Organic Matter in Rock Samples From Different Depths Viewed Under the Microscope

[illegible]	2) [illegible]			16) [illegible]	17) C_{org} [illegible]	H/C
	3) [illegible]	6) [illegible]	11) [illegible]	R°(%)	(%)	
[illegible] ([illegible])	4) [illegible]	7) [illegible]	12) [illegible]	0.29	2.01	[illegible]
[illegible] ([illegible])	5) [illegible]	8) [illegible]	13) [illegible]	0.58	1.86	2.317
G26 ([illegible])		9) [illegible]	14) [illegible]	1.01	1.43	2.204
[illegible] ([illegible])		10) [illegible]	15) [illegible]		1.85	2.278

Key:

1) Name of well and depth of the section of the well from which sample is taken (meters)
2) Characteristics seen under the microscope
3) Structural characteristics
4) Presence of clear woody and glassy coal structures and lipoids
5) Remnant woody and glassy coal structure)

[key continued]

[continuation of Table 1 key]

6) Color under light
7) Light reddish brown
8) Reddish brown
9) Brownish drab
10) Brownish drab
11) Characteristics of fluorescence
12) Presence of relatively light yellowish brown fluorescence
13) Weak yellowish brown fluorescence (pieces of spores emit blue gray fluorescence)
14) Brownish black fluorescence
15) Weak dark brown fluorescence
16) Reflectance
17) $C_{organic}$ content

2. Study of Organic Carbon ($C_{organic}$) in Rocks

The percentage content of organic carbon in rocks not only reflects the richness of the primitive organic substance but also reflects the degree of evolution of organic matter. As gaseous and liquid hydrocarbons and other compounds containing carbon (such as CO_2) are released (or move about), the content of organic carbon visibly drops. This characteristic is shown in the contents (listed in Table 1) of organic carbon in samples of different depths of this region as measured by nonwater titration.

3. Study of the Composition of Extractants in Organic Solvents

Reliable and effective separation analysis of extractants in rocks by organic solvents is a most commonly used method in studying the evolution of petroleum. It is generally believed that temperature is the basic parameter affecting the evolution of petroleum. To avoid loss or change in content or composition of dissolvable organic components due to condensation-polymerization as a result of heating over a long period in the water bath of extractants in organic solvents during the return extraction process, the writer used cold extraction (soaking) to treat the samples. In the separation analysis in organic solvents of the extractants of samples from different depths of this region it was discovered that as the burial depth increases, the percentage content of chloroform asphalt A in a unit of organic carbon (A/$C_{organic}$ percent) increases. The content of saturated hydrocarbons in chloroform asphalt A (SHV/A percent) also gradually increases. The content of saturated hydrocarbons in a unit of organic carbon (SHC/$C_{organic}$ percent) rapidly increases while the content of nonhydrocarbons in chloroform asphalt A drastically drops (Table 2). In addition, the green pigment and porphyrin also manifest a relationship of corresponding increase and decrease. Especially significant is the relationship of change between depth and some organic molecules (Figure 1, Figure 2 and Table 2) separated by gas-liquid chromatography and determined by the combined chromatograph-mass spectrometer. As the burial depth increases, the content of light components of normal paraffin visibly increases, and the ratio of 2,6,10,14-tetramethyl pentadecane and 3,7,11,15-tetramethyl hexadecane, the ratio of n-heptadecane and 2,6,10,14-tetramethyl pentadecane ($n-C_{17}/P_{r1}$), the ratio of n-octadecane and 3,7,11,15-tetramethyl hexadecane ($n-C_{18}/P_h$) and the relative content of normal-2,6,10,14-tetramethyl pentadecane ($N-P_{r1}$) all visibly increase.

4. Study of the (H/C)

The contents of C and H in the residue left over after asphalt was extracted were measured by weight, and the H/C ratio of the atomic numbers was calculated. It was discovered that the H/C ratio of atomic numbers lessens as depth increases (Table 1).

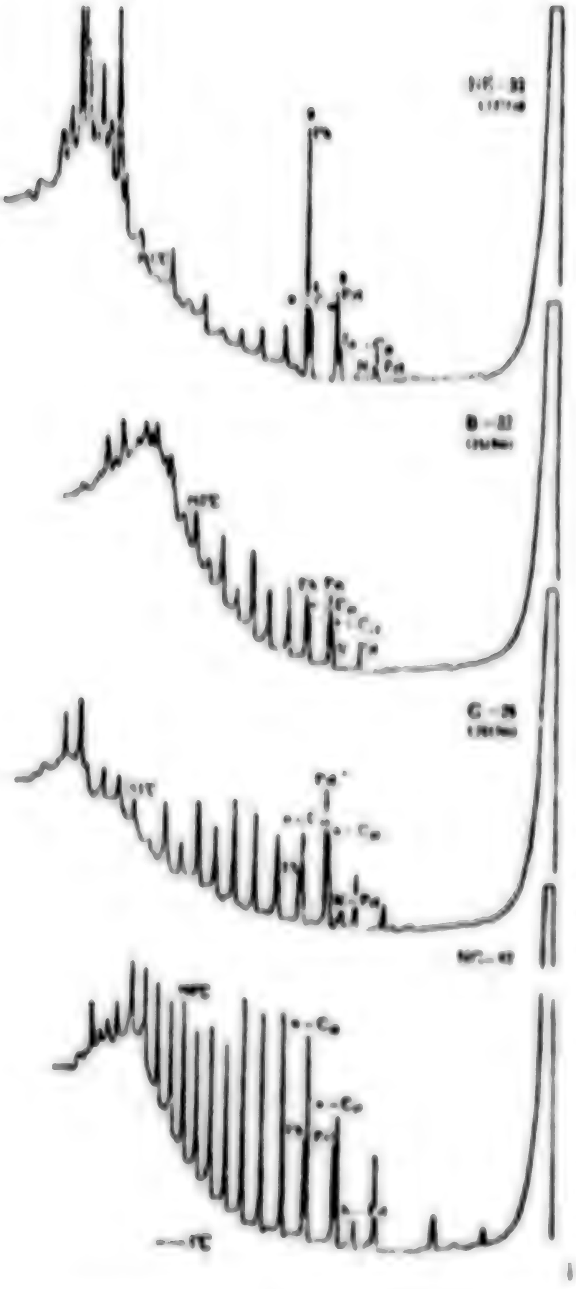
Table 2. Changes in the Organic Matter of Samples from Different Depths

1) [illegible] ([illegible])	2) [illegible] A (%)	3) C[illegible] (%)	4) A/C[illegible] (%)	5) [illegible] (SHC) (%)	SHC/A (%)	SHC/C[illegible] 6) (%)	7) [illegible] (AHC) (%)	AHC/A (%)
NK32(1477)	0.2145	2.91	7.37	0.0349	16.3	1.2	0.0658	32.7
N22(2?10)	0.1022	1.66	6.6	0.0263	25.7	1.42	0.0229	22.4
G28(2671)	0.1271	1.43	8.69	0.0400	31.6	2.8	0.0365	28.7
NG57(3478)	0.4478	1.85	24.21	0.2210	49.6	11.95	0.0977	21.8

AHC/C[illegible] 8) (%)	[illegible] 9) (%)	[illegible]/A 10) (%)	11) [illegible] (ppb)		P_{r1}/P_h	$n-C_{17}/P_{r1}$	$n-C_{18}/P_h$	$N-P_{r1}/P_{r1}$
			12) [illegible]	13) [illegible]				
2.38	0.1031	49	3.5	0.296	0.26	0.37	0.36	0.078
1.23	0.0418	40.9	0.73	0.72	1.11	0.61	0.5	0.025
2.55	0.0268	21.1	10		2.90	2.0	0.68	0.129
5.28	0.0477	10.6			1.04	2.11	1.31	0.31

Key:

1) Number of well and depth of the section of the well from which sample is taken (meters)
2) Chloroform asphalt A in rocks (%)
3) $C_{organic}$
4) $A/C_{organic}$
5) Saturated hydrocarbons in rocks
6) $SHC/C_{organic}$
7) Aromatic hydrocarbons in rocks
8) $AHC/C_{organic}$
9) Nonhydrocarbons
10) Nonhydrocarbons/A
11) Content of pigments
12) Porphyrin
13) Green



(SCOT column, column length: 30 meters; Stationary phase: SE-30, Gas: He, Pressure in front of column: 2.5 kilograms/centimeter^2), 1,2,3,4,5, are spectral peak numbers used in quantitative chromatographic-mass spectrometric analysis. $N\text{-}P_{r1}$, $n\text{-}C_{17}$, P_{r1}, $n\text{-}C_{18}$, P_h separately represent the normal-2, 4,10,14-tetramethyl entadecane, n-heptadecane, 2,6,10,14-tetramethyl pentadecane, n-octadecane and 3,7,11,15-tetramethyl hexadecane

Figure 1. Chromatograms of hydrocarbons in samples from different layers of Es_1^{middle} of Dagang Oilfield

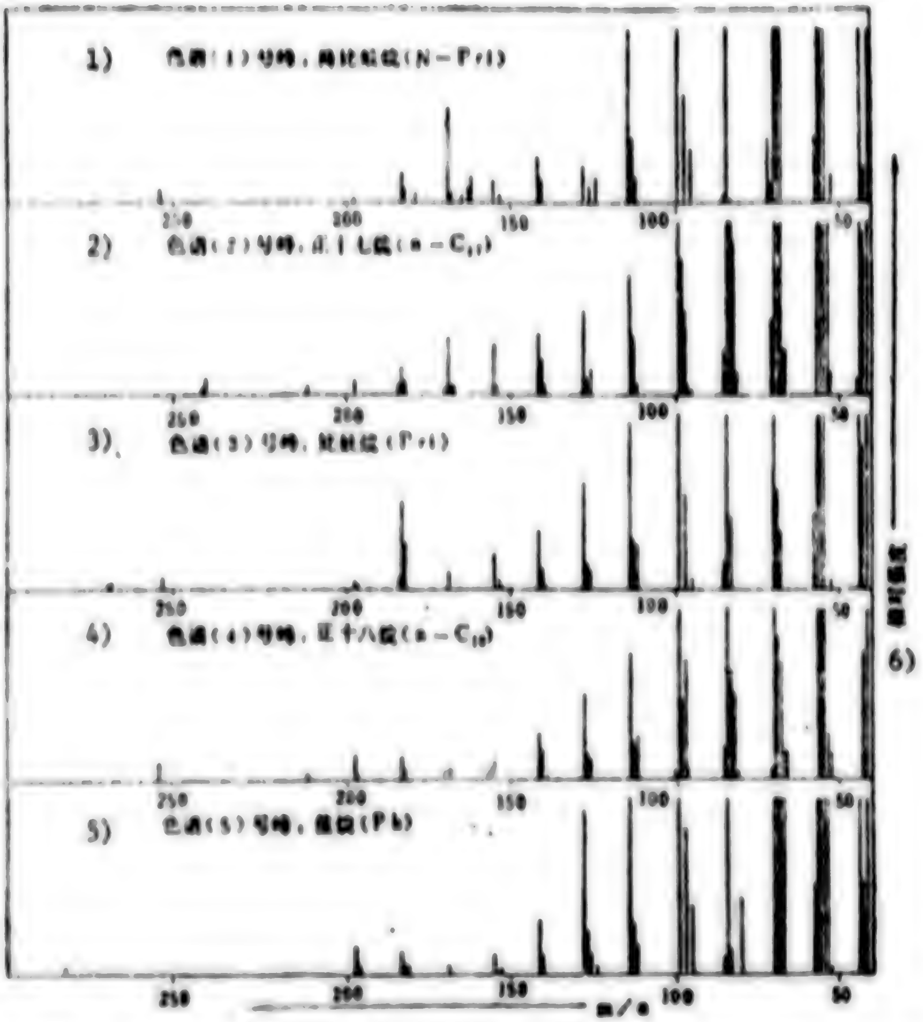


Figure 2. Mass spectrograms of components of chromatographic peaks Nos. 1,2,3,4,5 of Figure 1

Key:
1) Chromatogram (1) peak: normal-2,6,10,14-tetramethyl pentadecane ($N\text{-}P_{r1}$)
2) Chromatogram (2) peak: n-heptadecane ($n\text{-}C_{17}$)
3) Chromatogram (3) peak: 2,6,10,14-tetramethyl pentadecane (P_{r1})
4) Chromatogram (4) peak: n-octadecane ($n\text{-}C_{18}$)
5) Chromatogram (5) peak: 3,7,11,15-tetramethyl hexadecane (Ph)

(Instrument: Domestically produced ZhD-01 model chromatograph-mass spectrometer. Condition: Chromatograms are the same as in Figure 1. The total ionization voltage of the ion current of the mass spectrogram is 20 ev, the ionization voltage of the mass spectrogram is 70 ev, the emission electric current is 400μA, the acceleration voltage is 4 KV, the high voltage of the electronic multiplier is 2 KV).

III. Discussion of Results and Artificial Simulation Experiment

It can be clearly seen from the above analysis that the evolution of petroleum of the region being studied possesses the following characteristics:

1. Near 1477 Meters

The gelatinated components of organic matter of the rocks appear light reddish brown under light. They have a very low reflectance under reflection (Table 1). They also retain woody and glassy coal structures which are present in the low level coalificated stage and coarse organic pieces of the lipoid group are also present. In addition, hydrogenation and carbonification (H/C) also reached the highest values in this region. It can be seen from Table 2 that even though the content of chloroform asphalt A reached 0.2145 percent, the corresponding content of paraffin hydrocarbons was only 16.3 percent, the ratio of paraffin hydrocarbons and organic carbon ($SHC/C_{organic}$) was only 1.2 percent, while nonhydrocarbons constituted 49 percent of the total amount of chloroform asphalt A. The content of 3,7,11,15-tetramethyl hexadecane was high (Figure 1). The ratio of 2,6,10,14-tetramethyl pentadecane and 3,7,11,15-tetramethyl hexadecane, the ratio of n-heptadecane and 2,6,10,14-tetramethyl pentadecane, and the ratio of n-octadecane and 3,7,11,15-tetramethyl hexadecane were all below 0.5. The odd-even superiority of normal paraffin hydrocarbons was very obvious. The content of green pigment was very high. These are all reflections of a low degree of maturity of organic matter. Judging from the changes in the saturated hydrocarbons and aromatic hydrocarbons in the rocks of the Es_{I}^{middle} stratum of this region along with changes in depth (Figure 3), this depth obviously has not reached the minimum depth for petroleum genesis, i.e., it has not reached the upper limits for the evolution of petroleum.

2. Near 2519 Meters

The gelatinated constituents in the rocks show visible changes in optical properties when viewed under transmissive and reflective light (Table 1). The H/C ratio visibly drops but remnant woody and glassy coal structures indicating a rather low degree of maturity are still present, and the pieces of spores show a blue gray fluorescence indicating little metamorphism. Table 2 and Figure 1 also show some characteristics that reflect a low degree of maturity. These include the asphalt conversion coefficient ($A/C_{organic}$) which is only 5.5 percent, an increase of only 0.21 percent in the content of saturated hydrocarbons in a unit of organic carbon when compared to that at 1477 meters, the amount of nonhydrocarbons which constitutes over 40 percent of the total amount of asphalt, a relatively high content of green pigment, an extremely low relative content of normal-2,6,10,14-tetramethyl pentadecane. But, at the same time, there are some indicators of an increased degree of maturity such as the 9 percent

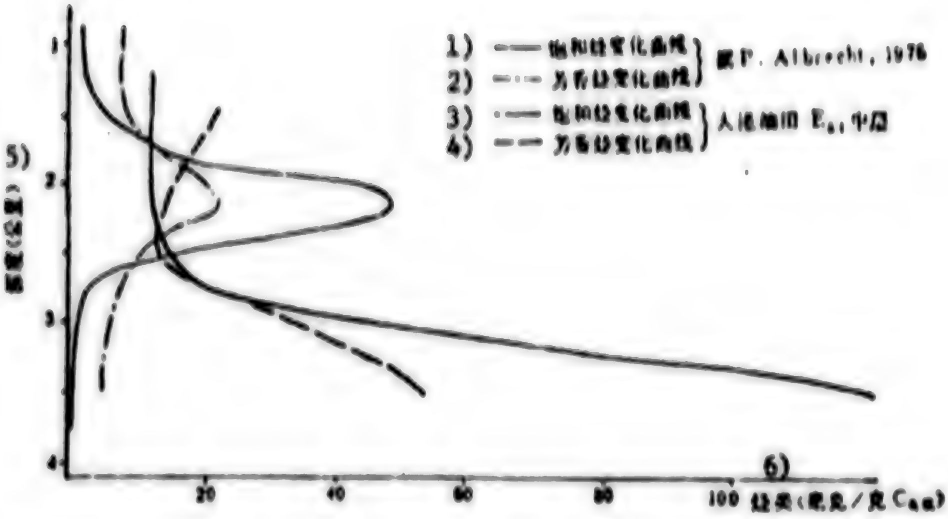


Figure 3. Relationship between depths and saturated and aromatic hydrocarbons in the sample of the E_I middle stratum of the Dagang Oilfield

Key:

1) The curve of changes of saturated hydrocarbons } According to P. Albrecht, 1976
2) The curve of changes of aromatic hydrocarbons }

3) The curve of changes of saturated hydrocarbons } E_{s1} middle stratum of
4) The curve of changes of aromatic hydrocarbons } the Dagang Oilfield

5) Depth (meters)
6) Hydrocarbons (milligram/gram $C_{organic}$)

(With the superimposed graph of the relationship between depths and saturated and aromatic hydrocarbons from the Douala Basin's Logbaba rock series--according to P. Albrecht, 1976)

increase in the corresponding content of saturated hydrocarbons in the total amount of chloroform asphalt A (about the same as the amount of reduction of nonhydrocarbons), a visible reduction in the content of 3,7,11,15-tetramethyl hexadecane, an increased ratio of P_{r1}/P_b to 1.11, and increases of n-C_{17}/P_{r1} and n-C_{18}/P_b to over 0.5. The high temperature constituents of over 260°C shown in the chromatogram are simpler than those in the samples taken from 1,477 meters and the contents are less. The above characteristics indicate that at this locality, this depth possesses characteristics of a critical depth marking mature and immature organic matter. It can be clearly seen from Figure 3 that the hydrocarbons that form the basis of petroleum only visibly increase below this depth. This further indicates that this depth actually reflects the upper boundary of evolution of petroleum of this area.

3. From 2519 Meters to 3478 Meters

The color of the gelatinated components or organic matter darkens and the rocks have high reflectance. The color of fluorescence has changed to dark brownish drab or brownish black. The woody structures have completely disappeared. The ratio of hydrogen and carbon is small (to about 0.191). The content of chloroform asphalt A and the asphalt conversion coefficient have rapidly increased. The relative contents of hydrocarbons have almost reached half the total amount of asphalt while the nonhydrocarbons has dropped to about 10 percent. There is a further increase of methyl and secondary methyl groups (Figure 4, 3.37-3.5 μ) in nonhydrocarbons. Benzene nuclei (5.85 μ) have decreased, and the number of CH (11.3 - 13.7 μ) on the benzene ring has decreased. The amount of 3,7,11,15-tetramethyl hexadecane has further decreased. The ratio of 2,6,10,14-tetramethyl pentadecane and 3,7,11,15-tetramethyl hexadecane and the ratio of normal-2,6,10,14-tetramethyl pentadecane and 2,6,10,14-tetramethyl pentadecane ($N-P_{r1}/P_{.1}$) have all visibly increased. The corresponding content of n-paraffin hydrocarbons has increased. The odd-even superiority of n-paraffin hydrocarbons has weakened (Figure 1). The $n-C_{18} > P_h$ and $n-C_{17} > P_{r1}$ characteristics all indicate that the organic matter at this depth has reached a more mature stage and has approached the thermodynamic conditions most beneficial to the genesis of petroleum. But analysis of the trends of change in Figure 3 shows that the maximum limit has not been reached.

Obviously, the critical values of depth (or temperatures) of burial of each stage in the evolution of petroleum described in this article are markedly different from the research results obtained by M.C. Louis, et al, (1967), B. Tissot, et al(1971) and P. Albrecht (1971). Louis and Tissot separately determined the depth (and temperature) of massive petroleum genesis in the Toarcian Shales of the lower Jurassic under the Paris Basin was 1400 to 1500 meters (60°C), while Albrecht, after studying the Logbaba rock series of the upper Cretaceous in the Douala Basin, determined that the depth (and temperature) of massive genesis of petroleum was 1200 meters (65-70°C), and the maximum depth was 2,200 meters. Beyond a depth of 2,200 meters, the amount of genesis of petroleum rapidly drops and petroleum begins to crack to become gaseous hydrocarbons. At about 3,000 meters, the stage of genesis of petroleum basically ends. The results of our studies indicate that at a depth of about 2,500 meters (temperature between 85 and 90°C), the stage of massive petroleum genesis just begins and it seems that the maximum value has not been reached at a depth of 3,500 meters.

To check the reliability of the pattern of evolution of petroleum in the Huanghua Depression studied, and to explore the basic causes of the differences in the critical depths (or temperatures) of the evolutionary stages, the writer conducted an artificial simulation experiment of the evolutionary process of petroleum under different temperatures and pressure conditions utilizing the mudstones of the E_I middle stratum of the NK32 Well which have a low degree of maturity in the region studied and the recent pelagic silt far away from major navigational channels in the Bay of Bohai. The experiment was conducted inside a stainless steel high pressure caldron. Three samples of mudstone and pelagic silt ground into 80 granules each (each is about 100 grams in dry weight) were wrapped in nickel foil and then placed in 6 high-pressure caldrons and the experiment was conducted according to conditions listed in Table 3. To avoid oxygen from taking part in high temperature reactions, the air inside the high pressure caldrons were removed by liquified nitrogen before the experiment. After the experiment, the contents of chloroform asphalt A and $C_{organic}$ in the samples were separately measured according to the methods described above. The components of the three experimental samples of the Es^{middle} stratum of the NK32 Well were systematically separated and analyzed. The results of analysis are shown in Table 3 and Figure 5.

Table 3. Artificial Simulation of Evolutionary Conditions of Petroleum and Results of Analysis of Organic Components of Experimental Samples

1) 样品编号	5) 反应条件			9) $C_{有机}$ (%)	10) 氯仿沥青 A (%)	11) $A/C_{有机}$ (%)
	6) 温度 (°C)	7) 压力 (公斤/平方厘米)	8) 时间 (小时)			
NK32-1	150	610	100	2.95	0.1568	5.32
NK32-2	250	850	100	2.64	0.3940	14.92
NK32-3	350	1090	100	2.25	1.5055	66.91
2) 海泥-1	150	350	100	0.53	0.0311	5.87
3) 海泥-2	250	610	100	0.54	0.0374	6.93
4) 海泥-3	350	850	100	0.52	0.0438	8.42

12) 饱和烃 (SHC) (%)	13) $SHC/C_{有机}$ (%)	SHC/A (%)	P_{r}/P_{h}	$n\text{-}C_{17}/P_{r}$	$n\text{-}C_{18}/P_{h}$	$N\cdot P_{r}/P_{r}$
0.0321	1.09	20.47	0.38	0.42	0.33	0.127
0.0704	2.67	17.87	0.70	0.60	0.79	0.157
0.2569	11.42	17.08	1.53	1.00	2.27	0.248
0.0177	3.34	56.91	0.729	1.088	0.971	0.210
0.0188	3.48	50.27	0.131	1.232	1.316	0.210
0.0197	3.79	41.98	0.811	1.776	1.680	0.540

Key:
1) Sample number
2) Pelagic silt-1
3) Pelagic silt-2
4) Pelagic silt-3
5) Conditions of reaction
6) Temperature
7) Pressure (kilogram/centimeter^2)
8) Time (hour)
9) $C_{organic}$
10) Chloroform asphalt
11) $A/C_{organic}$
12) Saturated hydrocarbons
13) $SHC/C_{organic}$

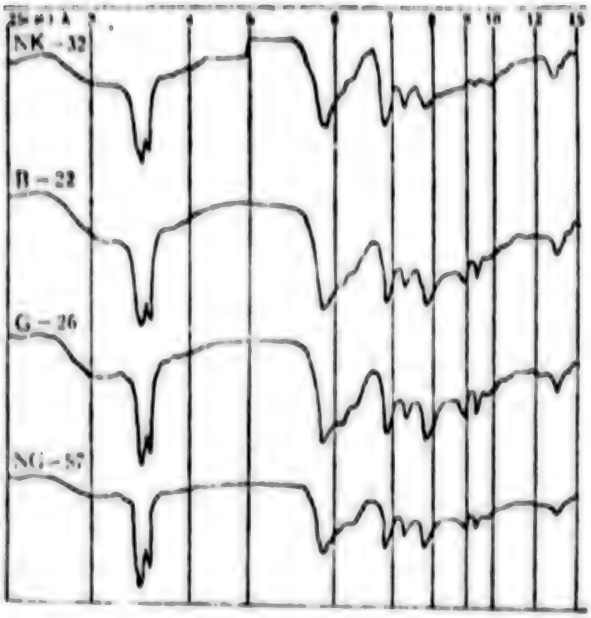
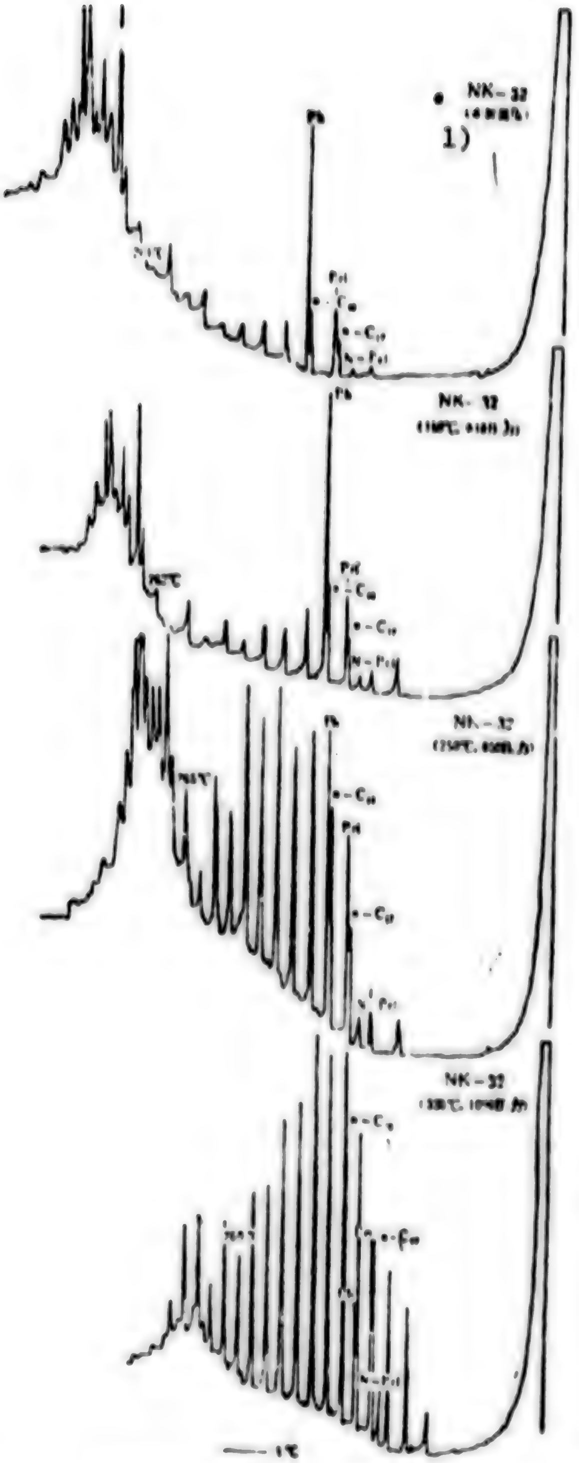


Figure 4. Infrared spectra of nonhydrocarbons in samples from different depths of the Es_{I}^{middle} layer of the Dagang Oilfield

It can be clearly seen from Figure 5 and Table 3 that the artificial simulation experiment has satisfactorily repeated the characteristics of the evolution of petroleum in this region. As temperatures and pressure increase, the $C_{organic}$ percent drops according to pattern. The content of chloroform asphalt A, the ratio of chloroform asphalt A and $C_{organic}$, the content of saturated hydrocarbons, the ratio of saturated hydrocarbons and $C_{organic}$, the ratio of 2,6,10,14-tetramethyl pentadecane and 3,7,11, 15-tetramethyl pentadecane, the ratio of n-octadecane and 3,7,11,15-tetramethyl hexadecane, and the ratio of normal-2,6,10,14-tetramethyl pentadecane and 2,6,10,14-tetramethyl pentadecane all gradually increased. The corresponding content of 3,7,11,15-tetramethyl hexadecane dropped in a regular pattern, the content of n-paraffin hydrocarbons increased, the light components increased, and high temperature components above 260°C were gradually covered by the newly formed n-paraffin hydrocarbons. These results indicate that temperature and pressure are indeed the major factors controlling the evolution of petroleum. The depth of burial that is functionally related to temperature and pressure can be completely reasonably taken as the important basis for determining the degree of evolution of petroleum. But in this experiment, the temperatures for massive genesis of petroleum were between 150 and 250°C, not only are they much higher than the temperature for petroleum genesis (60 to 65°C) proposed by B. Tissot and P. Albrecht but are also higher than the results (85 to 90°C)



(SCOT column: Column height is 30 meters, Stationary phase is SE-30, Gas: He. Pressure in front of column: 2.5 (kilograms/centimeters^2), N-P_{r1}: normal-2,6,10,14-tetramethyl pentadecane, n-C_{17}: n-heptadecane, P_{r1}: 2,6,10,14-tetramethyl pentadecane, n-C_{18}: n-octadecane, P_h: 3,7,11,15-tetramethyl hexadecane)

Figure 5. Chromatograms of paraffin hydrocarbons in the experimental samples under different temperature and pressure conditions

Key: 1) NK-32 (without pressure)

of the study of the Es_1^{middle} stratum in this article. This may be due to the fact that the experiment lasted only for 100 hours. The effects of temperature and time in the evolution of petroleum, as J. Connan (1974)(8) pointed out on the basis of the principles of chemical dynamics: "The effect of lower temperatures can be supplemented by longer duration of action." To obtain the same results of petroleum genesis in a new earth stratum requires much higher temperatures than in the old stratum. Therefore, the critical temperatures for the evolution of petroleum in the old Tertiary of the Bay of Bohai must necessarily be higher than that of the upper Cretaceous of the Douala Basin and the lower Jurassic of the Paris Basin, and the depth must correspondingly increase. In fact, this is the reason that autogenic industrial oil deposits have not been found since this is a shallow burial section which possesses some good burial conditions and conglomeration of organic matter but lacks the necessary conditions for conversion for the genesis of petroleum. This point also has actual significance in the search for oil in the Cenozoic Era of other places in our nation.

Conclusions

It can be concluded from the artificial simulation experiment and actual geological study that:

As the depth of burial (temperature, pressure) increases, all kinds of organic components change correspondingly in both quality and quantity. Studying the direction of change, characteristics and scale has very important meaning in the classification of the stages of maturity of organic matter (or the stages of evolution of petroleum).

The degree of change of the organic components and the massive genesis of petroleum are related to definite thermodynamic conditions. At the same time, they are closely related to the duration of the action of temperature and pressure. The most favorable depth for the genesis of petroleum of different regions and different eras of the earth strata obviously cannot be the same. To determine the most favorable depth for petroleum genesis and to mark out future petroleum prospecting regions based upon such determination have definite practical significance in achieving greater, faster, better and more economical results in the development of our nation's petroleum resources.

During our work in the field, we received a lot of assistance from the geological department of the Dagang Oilfield. In the process of analysis and testing, we received assistance from the laboratory of the Eighth Petroleum General Survey and Prospecting Team of Guizhou. In conducting $C_{organic}$ and H/C analysis, our institute's comrades Peng Wenshi [1756 2429 0013] and Liu Gaokui [0491 7559 7608] helped to perform infrared spectroscopic analysis, comrades Jiang Shanchun [1203 0810 2504], Xu Fenfang [1776 5358 5364], Ge Zhichang [5514 3112 1603] helped to perform gas and liquid chromatographic analysis and chromatographic-mass spectrometric

analysis. The work was completed without difficulties with their help. Special mention is made here to thank professors Tu Guangzhi [3205 0342 3589], Wang Zhuqing [3769 6999 7230] and assistant Professor Fu Jiamo [0265 1367 6206] who provided guidance and who reviewed this thesis.

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REFERENCES

1. Tissot, B. et al, 1971, "Origin and Evolution of Hydrocarbons in Early Toarcian Shales, Paris Basin France." Bull. AAPG 55.

2. Tissot, B. et al, 1974, "Influence of Nature and Diagenesis of Organic Matter in Formation of Petroleum," Bull. AAPG 58.

3. Louis, M.C. et al, 1967, "Influence de la Temperature et de la Pression sur la Formation des Hydrocarbures Dans les Argiles Kerogene" 7th W.P.C. Proc. V.2.

4. Kartzev, A. et al 1972, "The Principal Stage in the Formation of Petroleum" 8th W.P.C. Proc.V.2.

5. Albrecht, P., 1976 "Geochemical Studies on the Organic Matter from the Douala Basin (Cameroon)—I Evolution of the Extractable Organic Matter and the Formation of Petroleum." Geochim. et Cosmochim. Acta 40.

6. Fu Jiamo [0265 0342 3589], Shi Jiyang [0670 4949 2254], 1975 "Theory and Practice of the Evolution of Petroleum--I The Mechanism of the Evolution of Petroleum and the Stage of Evolution of Petroleum," GEOCHEMISTRY, No 2.

7. Fu Jiamo, Shi Jiyang, 1977, "Theory and Practice of the Evolution of Petroleum--II" "The Practical Model of Petroleum Evolution and the Practical Significance of Petroleum Evolution." GEOCHEMISTRY, No 2.

8. Connan, J., 1974, "Time-Temperature Relation in Oil Genesis" Bull. AAPG, 58.

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PHYSICAL SCIENCES

GEOCHEMISTRY OF CHINA'S OILFIELD WATER DISCUSSED

Beijing DIZHI PINGLUN [GEOLOGICAL REVIEW] in Chinese Vol 25 No 2, Dec 79 pp 64-69

[Article by Zhang Jinlai [1728 6855 0171] of 101 Team, Petroleum Geological Joint Brigade, State Geological Bureau: "On the Principal Characteristics and Classification of Oilfield Waters in China"]

[Text] 1. Introduction

The current classification of oilfield waters chiefly falls into the following categories:

1. Palmer's (C. Palmer, 1911) classification is based on the percentage ratios of the milligram equivalents of ionic groups. As the system does not consider ionic concentrations, such constituents as chlorides and sulphates of alkali earth metals are grouped together. Although Ca^{++} and Mg^{++} are of the same subgroup in the chemical periodic table, their chemical actions often do not agree with each other. Thus, this system of classification is not so useful in studying the oilfield waters.

2. Sulin's method (V.A. Sulin, 1946) of classification is based on the comparative analysis of the characteristics of the chemical components of the current continental water and sea water, using the equivalent ratios of Na^+ and Cl^- in natural water as the basis of classification. Sulin believed that the formulation of oilfield water was neither dependent on the components of connate water nor the lithologic components of oil deposits. The four types of water classified under the Sulin system have been found in our country's oilfields, although most of them are $NaHCO_3$ and $CaCl_2$ types. Some oilfields contain more than two different types of water. Thus, the Sulin classification system poses some difficulties in interpreting oilfield waters in our country.

3. The Bojarski (L. Bojarski, 1970) method, which is the modification of Sulin's classification system, has greater limitations when applied in studying oilfield waters in our country. This is due to his division of Sulin's $CaCl_2$ type water into 5 subgroups based on the magnitude of the

$\frac{\gamma Na}{\gamma Cl}$ ratio, whereas $CaCl_2$ oilfield water accounts for less than one half in our country. The mean $\frac{\gamma Na}{\gamma Cl}$ value of this portion of oilfield water is approximately 0.8, and, in accordance with Bojorski's classification of $CaCl_2$ water under the first subgroup, it is detrimental to the preservation of oil, which presents a great contradiction.

4. Chebotarev, an Australian (I.I. Chebotarev, 1955), classified waters on the precondition that most of the underground waters were changed by atmospheric rainwater; in accordance with the relative ratios of dissolved HCO_3^-, $SO_4^=$, and Cl^-, natural waters were divided into three major groups, and the genetic classification of the waters was based on the percentage equivalents of negative ions. The drawback of this type of classification lies in the absence of salinity and positive ions. Practice shows that this kind of classification does not suit the characteristics of oilfield waters in our country either.

5. The French Schoeller method (H. Schoeller, 1955) classifies according to the concentration of chlorine. Although the fundamental idea is correct, due to the fact that its classification is based on oilfield brine, it is not entirely suitable for our country's oilfield waters. Moreover it does not identify the difference of ion contents in oilfield waters.

In light of the preceding methods, and by absorbing their strong points based on the characteristics and formulation laws of oilfield waters in our country, this article discusses a plan for classifying oilfield waters in China so as to help bring about our own theories on oilfield waters. Owing to [the author's] limited level, there are bound to be some mistakes, which [I] earnestly hope [the readers] will point out.

II. The Basic Characteristics of Oilfield Waters in Our Country

The enormous volumes of data provided for hydrogeochemistry over the past 30 years from general oil surveys and the development of oilfields in our country indicate that our country's oilfield waters have their own unique features and distribution patterns.

In 1974, we came up with several characteristics of China's oilfield waters (1), and we have further deepened our understanding of the characteristics through research over the past few years. Following is a brief description of the most important characteristics.

The most striking feature of China's oilfield waters lies in the great chemical composition variations. The average salinity is 5-30 grams per liter, the minimum of which is approximately 2 grams per liter, and the maximum can reach over 300 grams per liter. The basic characteristic of land facies sediments lies in the great variety of sedimentary formation. Based on the salt contents in the water body of sedimentary basins, the various kinds of sedimentation may be classified as follows: fresh water type, fresh/salty water intermediate type, brine type and rich salt [5221 7770] type. Undoubtedly, owing to the variety of sedimentary rocks, the chemical compositions of oilfield waters in China. If we compare the present with the ancient past, we will find that tremendous changes have taken place in the chemical composition of modern land facies water, and the salinity varies from 0.03 grams per liter to 440 grams per liter (2). The subsurface waters in the land facies layers originated from land facies waters. As they were derived from terrestrial source waters, the salinities of oilfield waters in our country very greatly. Although they do not completely agree with the variations of continental waters, in view of the fact that oilfield waters are buried deep underground where the hydrodynamic conditions are stable, concentration is bound to occur. It is suggested that the chlorine contents in mudstones can be used to represent the salinity of water bodies during their sedimentation period. The Cl contents in mudstones which had sedimented in the saline water of many basins in our country are over 1000 ppm; the Cl contents in oilfield waters average 60,000 ppm, which is 60 times concentrated; the Cl contents in mudstones which had precipitated in fresh water approximate 80 ppm; the Cl contents in oilfield waters are about 2,500 ppm, which is 30 times concentrated.

On examining the heavy water distribution characteristics of natural waters, we will find that within the entire hydrologic cycle, the heavy water distribution generally follows the pattern of "2 highs, 1 low, 1 stable," i.e. the evaporation effect is much higher than the surface water body; the oilfield water is high; the atmospheric precipitation is low; through soil and rocks, heavy water can maintain its stability. Moreover, among the various kinds of waters, oilfield waters are of the most value.

The isotopes of oilfield waters are characterized by positive deuterium (D) and negative oxygen (O^{18}), whereas in atmospheric rainwater and surface runoff, D is negative and O^{18} is positive. The isotopic make-up of subsurface water, which is the transitional state between oilfield water and surface water, is characterized by negative D and negative O^{18}. The isotopic data indicate that the chemical composition of oilfield water was formed in the late period: This is due to the fact that land saline lake water contains positive D and positive O^{18}, whereas if oilfield waters were connate, they would also have positive D and positive O^{18}. Another type of test data indicate changes in the isotopic composition of waters caused by petroleum: fresh water containing negative D and negative O^{18} was injected into the oil layers and forced to come into complete contact with petroleum; when the fresh water was subsequently pumped out through the production well, it underwent changes marked by increased D and decreased O^{18}, which indicated that when waters from various types of sources came into contact with petroleum, they were all transformed into oilfield waters with positive D and negative O^{18} isotopic compositions, which is of great significance to the interpretation of the vertical zoning of oilfield waters in our country.

III. Theoretical Basis and Discussion of the Proposed Classification of Oilfield Waters in Our Country

Many researchers unanimously agree that after a given geological-geochemical process, a given geochemical index is bound to become a statistical parent population, which always has a corresponding theoretical probability distribution. Based on this principle, probability statistics reveal that the oilfield waters in our country can be classified into four different genetic types: as China's oilfield waters are arranged according to their salinity from the lowest to the highest order, and subjected to probability computation, four unitary sections will appear in the probability distribution graph (Figure 1). The salinities at various sections of different slopes are: 80-170, 170-420, 420-4,000, 4,000-11,000 mg equivalents per liter.

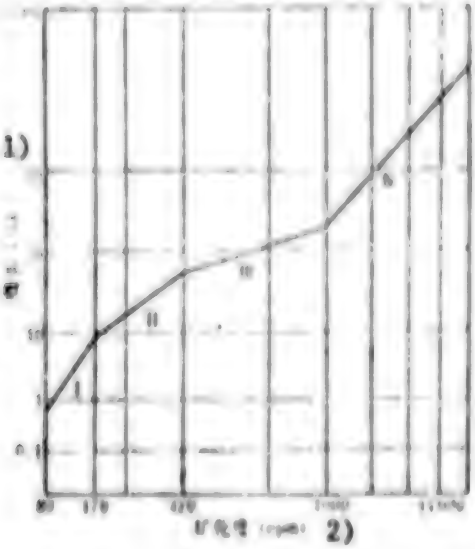

Figure 1. Logarithm probability graph of oilfield water salinity in our country

Key: 1) probability (%) 2) salinity (epm)

Our studies of the distribution patterns of oilfield water salinity at various slope sections indicate that oilfield waters of different slope sections are chiefly related to whether rainfall eluviation occurred during the sedimentation formation and geohistorical period of source reservoir rocks, and whether fault activities had caused atmospheric rainwater infiltration. They are not related to the ages of source reservoir rocks. Thus, based on Chebotarev's principle of classifying the waters in various hydrodynamic zones according to their salinities into different hydrochemical facies (3), China's oilfield waters are classified into four different kinds of hydrochemical facies (Table 1).

Table 1. General Conditions Under Which Oilfield Waters of Various Slope Sections Had Formed

Slope Section	I	II	III	IV
General geological conditions	fresh-water sedimentation, heavy rainfall eluviation during geohistorical period continental water infiltration	fresh water sedimentation; saline water or brackish water sedimentation. Eluviation or rainwater infiltration caused by fault activity during geohistorical process	saline water sedimentation or fresh/saline water transitional sedimentation	rich salt sedimentation
period of source reservoir rock	N	N, K, J	N, K, J	N-K
hydrochemical facies	low saline facies	medium saline facies	strong saline facies	high saline facies

Our further studies of the four different genetic types of oilfield waters revealed the following features and distribution patterns:

(1) The Cl^- and Na^+ components of different types of oilfield waters are distributed in a symmetric and positive pattern (Figure 2). Many researchers agree that the symmetrical positive distribution indicates that the randomness of control factors is the result of the superposition of multiple forces, i.e. the distribution of their densities is the reflection of various elements which are present in oil deposits. In the geological environment of oil reservoirs, the subsurface waters are under stable hydrodynamic conditions. Owing to the fact that the subsurface waters were in the concentration stage as the temperature rose, plus their very high dissolubility, they not only accounted for most of the oilfield waters, but were also relatively stable.

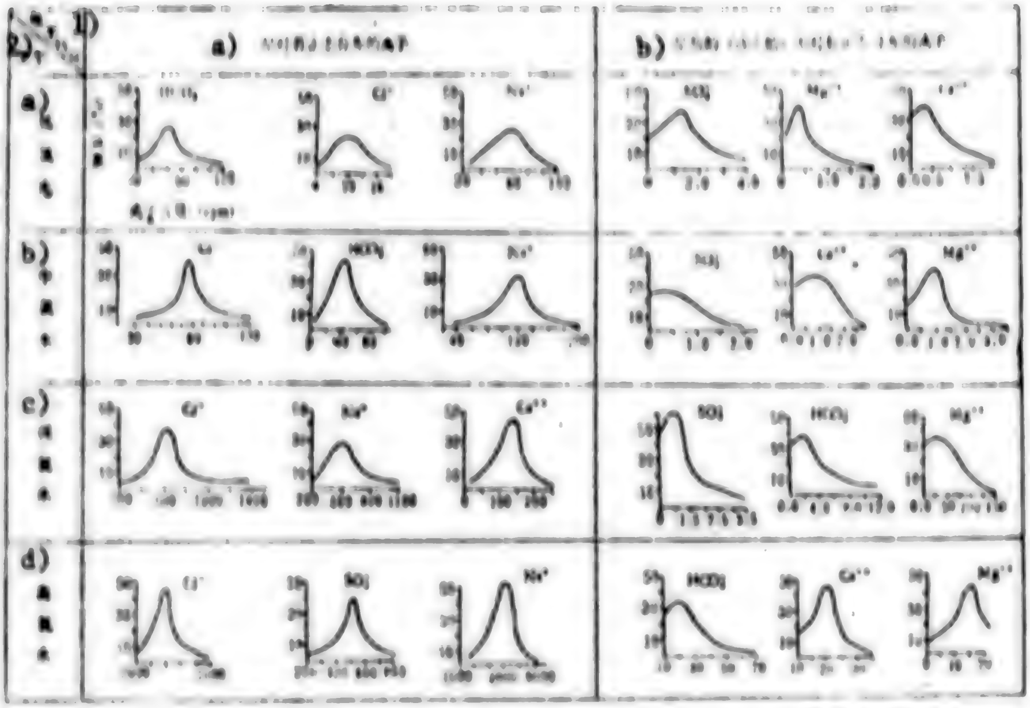

Figure 2. Probability distribution charts of various ions in different types of oilfield waters

Key: 1) probability characteristics
a) ions with symmetric positive distribution
b) negative positive ions with asymmetric positive distribution

2) type
a) low chlorine water
b) medium chlorine water
c) strong chlorine water
d) high chlorine water

vertical axis: frequency (%)
horizontal axis: ionic content (epm)

Chlorine is characterized by the following features: (1) Its contents are not influenced by oxidation-reduction or ionic absorption-exchange; (2) In oilfield waters, the correlation between chlorine and salinity is great; (3) Among the anions, chlorine is an independent variable, whereas salinity is easily affected by the variation of other ion contents.

Based on the preceding characteristics of chlorine, and in light of the following conditions, we decided to use the corresponding chlorine contents in different hydrochemical facies as the criteria for classifying different types of oilfield waters (Table 2).

Table 2. Comprehensive Classification Table of Oilfield Waters in Our Country

1)			2)			3) [illegible]			4)
5)	10)	11)	12) 13)	14)	15)	[illegible]	[illegible]	[illegible]	[illegible]
6) [illegible]	5–20	HCO_3, Cl, Na	<0.65	0.53	>1.30	0.80	12.71	16.27	16) [illegible]
7) [illegible]	20–130	Cl, HCO_3, Na	<0.45	0.40	>3.0	0.72	12.75	62.24	17) [illegible]
8) [illegible]	130–2000	[illegible]	<0.74	0.54	>3–5	7.25	12.64	5.10	18) [illegible]
9) [illegible]	2000–7000	Cl, SO_4, Na	<0.65	0.58	>5.0	101.2	13.76	127.72	19) [illegible]

Key:

1) type
2) coefficients
3) values of chemical characteristics (average values)
4) general genesis
5) classification
6) low chlorine water
7) medium chlorine water
8) strong chlorine water
9) high chlorine water
10) chlorine content (epm)
11) ionic combinations
12) ionic combination variable coefficients (Cv)
13) maximum value
14) average value
15) closure coefficient
16) fresh water sedimentation, atmospheric rainwater eluviation during geohistorical period; continental water infiltration
17) fresh water sedimentation; saline or brackish water sedimentation; eluviation during geohistorical period, or atmospheric rainwater infiltration caused by fault activities
18) saline water sedimentation or fresh/saline water transitional sedimentation
19) rich salt sedimentation

Explanatory Note: Ionic combination variable coefficient:

$$C_v = \frac{\delta}{\bar{x}}, \quad \delta = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}, \quad \bar{x}$$

in which $\bar{x}$ is the average value of ionic combinations, x_i is the contents of each ion (epm) in the ionic combinations. (Each ion within an ionic combination is regarded as a sample; due to the poor criteria in sample computation, n is employed instead of n-1.)

When the numerical figures become inconveniently large, computation can be based on the specific modular coefficients. A specific modular coefficient is the ratio between each ion and average value in an ionic combination, i.e. $K_i = \frac{x_i}{\bar{x}}$. In terms of specific modular coefficients, the variable coefficient becomes: $C_v = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(K_i - 1)^2}$.

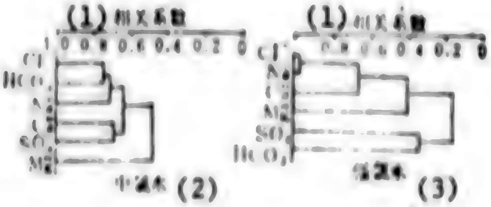

Figure 3. Diagram of ionic correlation in oilfield waters

Key: 1) correlation coefficient
2) medium chlorine water
3) strong chlorine water

Thus, the three ions are called "ionic combination" (arranged in magnitudinal order of mg equivalents per liter, and with anions ahead of cations). The ionic combinations vary with each individual type of oilfield water (Table 2).

Figure 2 also indicates the presence of negative (or positive) assymetrical distribution of the 3 ions in various types of oilfield water. According to researchers, the negative (or positive) assymetrical distribution patterns are often controlled by one major factor, and result from one kind of geochemical force.

The two kinds of distribution patterns of ionic contents in oilfield waters indicate a distinct differentiation in the ionic contents of oilfield waters which is chiefly caused by the differences in hydrogeochemical environments of oilfield waters as well as the different physical-chemical properties of the ions.

In mathematical statistics there is an important characteristic number known as variable coefficient (Cv). It measures the relative ionic diffusion data of a group of ions. When we group the data of an ionic combination to find the variable coefficient of the ionic combination (also called ionic potential coefficient), the magnitude of the latter represents the relative ionic diffusion of the ionic combination. As there are equal amounts of anions and cations in water, during the differentiation process of the ionic contents, the other three ions tend to decrease towards the minimum value, and the variable coefficients of the ionic combination becomes relatively small. Thus, the variable coefficients of oilfield water ionic combinations are smaller than those of natural waters. For example, surface waters with high concentrations and high chlorine oilfield waters are similar in salinity, but their ionic combination variable coefficients are remarkably different (Table 3).

Table 3. Comparison Table of Ionic Combination Variable Coefficients Between Highly Concentrated Surface Waters and High Chlorine Oilfield Waters

化学成分 1) 2) 类别	5) 阴阳离子（毫克当量/升）							6) Cl, SO_4, Na 组合变异系数
	K + Na	Mg	Ca	Cl	SO_4	HCO_3	矿化度	
3) 高度浓缩的地表水	3048.17	808.71	31.29	4157.40	84.00	6.57	8496.34	0.69
	3570.80	2150.92	262.60	6271.80	52.79	6.28	12568.84	0.77
4) 高氯油田水	5213.08	2.66	59.17	4811.42	482.48	0.008	10569.82	0.56
	3951.88	9.11	16.09	3325.65	732.47	17.13	8052.36	0.52
	3726.14	12.78	24.65	3101.97	644.21	58.26	7567.98	0.53

Key:
1) chemical composition
2) classification
3) highly concentrated surface water
4) high chlorine oilfield water
5) negative/positive ions (mg equivalents per liter)
6) Cl, SO_4, Na combination variable coefficient

(3) Based on the preceding classification, the distribution patterns of various types of oilfield waters in oil-bearing areas are as follows: In the source oil deposit area, there is generally only one kind of oilfield water; in fault block oil deposit areas, sometimes due to the atmospheric rainwater infiltration caused by fault activities, there are two types of oilfield waters.

Vertical variation: From below the local erosion basis all the way down to the oil and gas deposits, the ionic combinations generally undergo only one change from top to bottom (Figure 4). This type of vertical variation

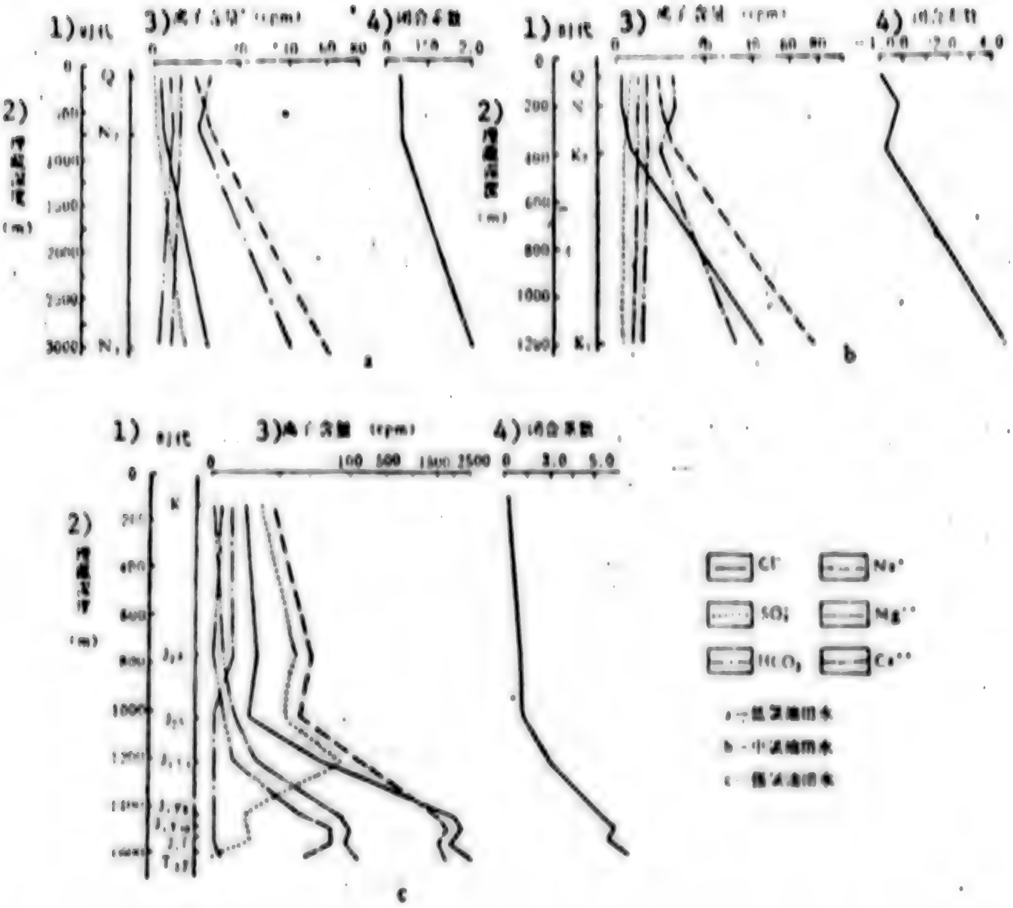

Figure 4. Vertical variation graphs of ionic contents and closure coefficients

Key:
1) age
2) depth (meter)
3) ionic content (epm)
4) closure coefficient

a) low chlorine oilfield water
b) medium chlorine oilfield water
c) strong chlorine oilfield water

pattern indicates that the vertical zoning of oilfields in our country is chiefly divided into top and bottom zones, and the transitional zones are not prominent. This phenomenon can be explained if we look into the late period genesis of China's oilfield waters as revealed in isotopic data: subsurface water is an extremely active liquid both chemically and physically, and it changes with the surrounding environment. Oilfield waters are found in the lower zone; due to transformations in the late period, they are now characterized by remarkable differentiations in ionic contents and heavy waters, and the isotopes are positive D and negative O^{18}. The upper zonal waters constitute the transitional state underground waters between oilfield waters and surface waters. As their environment differs from the lower zone, the heavy waters and ionic combinations are stable with no remarkable differentiations, and the isotopes are D negative, O^{18} negative. Thus, there is a striking difference between the ionic combinations in the upper and lower zones.

(4) Closure Coefficient. Ignatavich (N.K. Ignatavich) was the first to introduce the hydrogeological closure concept. But his introduction of the concept was based primarily on geological indices, and failed to convey it with coefficient values. On the basis of Ignatavich's hydrodynamic zoning, Sulin came up with hydrochemical characteristics, but likewise failed to express the concept in concrete terms. Gatalbskii (M.A. Gatalbskii) further developed Ignatavich's hydrodynamic zoning theory, i.e. the ratios between the salinity values (mg per liter) and depths of waters in test layers. When Gatalbskii's method is used in computing closure coefficients, at a certain depth, salinity increases begin to fall behind depth increases; thus, in a closed structure, the closure coefficients decrease with depth, which does not conform with the objective environment. Based on the consistent enrichment of bromine as it increases with depth, Krotova (V.A. Krotova) came up with "bromine gradient," i.e. the quotient resulting from the division of bromine contents (mg per liter) by water-bearing bed depth (meter). For the sake of convenience in application, the quotient is multiplied by 100. As the bromine contents tend to be low in land facies oilfield waters, the application of bromine gradient is somewhat limited. Based on our study of the vertical variations of different types of oilfield waters, our way of computing the closure coefficients is by dividing the ionic combination variation coefficients into the logarithm of chlorine contents (mg equivalents per liter). The variation patterns are shown in Figure 4 and Table 2.

(5) Some chemical characteristic values. In the early stages of oilfield water formation or during the period of absorbing external supplies, from the relatively high contents of such alkali earth metals as carbonates and sulphates to the formation of oilfield waters, alkali metal chlorides were predominant and saturation sedimentation of carbonates and sulphates occurred in between. Schoeller used the formulas $\sqrt{SO_4 \times Ca}$ and $\sqrt[3]{(HCO_3+CO_3)^2 \times Ca}$ to determine the relative saturation of sulphates and carbonates, which, to a certain degree, is of significant value in specifying the characteristics of oilfield waters in our country.

The arbitrary value of 70 for $\sqrt{SO_4 \times Ca}$ is used for indicating that an oilfield water is nearly saturated with sulphate. China's oilfield waters generally have a low value (Table 2), except for high saturation point of sulphates is one of the features of oilfield waters in our country, which conforms with the low-sulphate/high-paraffin characteristic of China's land facies crude oil. This was caused by the presence of metallic ions in water, and H_2S, which had been produced by bacterial reduction, captured Fe^{++}, Cu^{++}, Zn^{++}, etc, thus resulting in the precipitation of metallic sulphates into the rock layers.

In sea facies oilfield waters, $\sqrt[3]{(HCO_3+CO_3)^2 \times Ca}$ generally exceeds 7. In the case of Chinese oilfield waters, the value is even higher, averaging over 12, which shows that the oilfield waters in our country is characterized by relatively high carbonate saturation. Generally speaking, the value of $\frac{\gamma Na}{\gamma Mg + \gamma Ca}$ gradually reduces as salinity increases. Thus, it is relatively high in low chlorine and medium chlorine waters, and very low in strong chlorine water (Table 2), which reflects the direction of the water absorption/exchange process. But as the salinity continues to increase, the value also increases. According to foreign reports, in the case of sea facies oilfield waters, the value begins to increase when salinity reaches over 210 grams per liter (roughly equivalent to 6300 mg equivalents per liter). In China's oilfield waters, it begins to increase at about 4000 mg equivalents per liter. This puts the mean value for high chlorine water at 127.72.

Besides, the above ratio also reflects the influence of diagenesis on hydrochemical composition. This is because diagenesis causes the Mg^{++} and Ca^{++} in water to increase, causing a relative drop in the ratio.

REFERENCES

1. Rock Mineral Analysis Compiling Group, Rock Mineral Analysis, 1974, Geology Publishing House

2. Wang Yunpu, etc, "A Review on V.A. Sulin's Theory of Oilfield Water," ACTA GEOLOGICA SINICA, 1976, No 1

3. Collins, A. Gene, "Developments in Petroleum Science 1: Geochemistry of Oilfield Waters," pp 253-291, 1975, Elsevier Scientific Publishing Company, Amsterdam-Oxford-New York

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APPLIED SCIENCES

CALCULATING PRESSURE DISTRIBUTION ON FLAT HEADED REVOLVING BODY

Wuxi ZHONGGUO ZAOCHUAN [SHIPBUILDING OF CHINA] in Chinese No 68 Jan 80 pp 1-7

[Article by Cen Changyi [1478 7022 5939] and Meng Zhaoyin [5536 3564 1377]: "Calculating the Pressure Distribution on a Flat Headed Revolving Body"]

[Text] Abstract

This article discusses the use of a series of axisymmetrical vortex rings to simulate the nonviscous, incompressible axisymmetrical circumfluous flow about a flat headed revolving body and establishes the Fredholm integral equation of the first kind satisfied by the distribution of velocity over the surface of a flat headed revolving body. A numerical method to solve the equation and some numerical examples are also given. The results thus obtained are discussed and compared with related experimental data and other theoretical results.

(I) Introduction

There are many methods to calculate the distribution of pressure of nonviscous, incompressible axisymmetric flow on ordinary round-headed or pointed axisymmetric revolving bodies. Among the many methods using integral equations, most utilize axial distribution of singularities to treat the problems and reduce the problems to an integral equation of the first kind which has a relatively simple function form. But, this kind of physical model cannot be used to describe the circumfluous flow about a flat-headed body. The circumfluous flow about a revolving body must be simulated by the distribution of surface singularities. Among the methods of simulating the distribution of surface singularities, the more well known are the standard program[1] of McDonnell Douglas of the United States and similar programs of Duffanlt and Henshaw of Canada.[2] They all use the source ring to simulate the circumfluous flow about a revolving body. Britain's Vandrey uses a series of coaxial vortex rings as a substitute for the revolving body. Britain's Vandrey uses a series of coaxial vortex rings as a substitute for the revolving body and has established the integral equation satisfied by the distribution of the surface velocity of the revolving body. Kershaw[3] proposed a numerical method specifically to solve the integral equation established by Vandrey. Yet, all of these various methods that can describe the circumfluous flow about flat headed bodies, treat the problem as a Fredholm integral equation of the second kind and let the normal velocity of the surface of the body to equal zero to satisfy the boundary conditions. Compared to the integral equation of the first kind, the kernel function is more complex and the demands on computational capacity is rather large. Although this report also uses a series of vortex rings in place of the revolving body, the boundary conditions are satisfied by letting the flow function of the surface of the body equal zero, thus reducing the problem to a Fredholm integral equation of the first kind satisfied by the distribution of velocity. The numerical method that gives a solution to this kind of integral equation and when written as a computer program can be used to compute the surface or the pressure distribution on a flat headed axisymmetrical revolving body.

(II) The Integral Equation that Is Satisfied by the Distribution of Surface Velocity of a Flat-Headed Revolving Body

Examination of fixed constant, incompressible axisymmetrical circumfluous flow about a flat-headed revolving body is shown in Figure 1. A cylindrical coordinate system (x, y, θ) is used. Because the flow is axisymmetric, the flow is unrelated to θ. Let the x axis be the axisymmetric axis, and the (x,y) plane be the meridian plane.

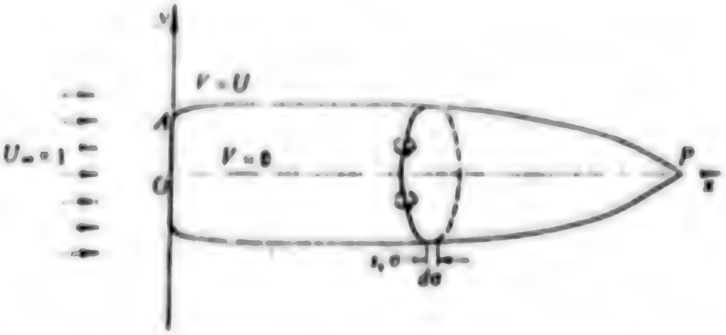

Figure 1. Axisymmetric circumfluous flow about a flat headed revolving body

Imagine pulling the object away and allowing the space previously occupied by the body to be filled by a stationary fluid. Since the velocity of the fluid inside the boundary is V=0, while the velocity of the fluid on the boundary of the object is V=U, the boundary surface of the object becomes the plane of discontinuity of the velocity of the fluid, and the discontinuity of the velocity of the fluid forms a vortex. Since the flow is axisymmetric, the vortex plane can be regarded as composed of a series of coaxial vortex rings. The intensity of the vortex Γ is the jump of the velocity through the vortex plane. Physically speaking, $\Gamma = -U$.[4]

Let the flow function at any point (ξ, η) on the surface of the body under an even on-coming flow of $U\infty = 1$ be ψ_∞, then

$$\psi_\infty = -\frac{1}{2}\eta^2 \tag{1}$$

The position of the center of the circle is x, the radius is y, and the flow function ψ_1 induced by the single vortex ring of intensity Γ at point (ξ, η) on the surface of the body is:[5]

$$\psi_1 = -\frac{\Gamma \cdot \sqrt{y \cdot \eta}}{2\pi}\left\{\left(\frac{2}{k} - k\right)K(k) - \frac{2}{k}E(k)\right\} \tag{2}$$

where K(k) and E(k) are the complete elliptical integrals of the first and second kind respectively, and k is the modulus of the elliptical integral:

$$k^2 = \frac{4y \cdot \eta}{(x-\xi)^2 + (y+\eta)^2} \tag{3}$$

Let ψ_1 be integrated over the surface of the entire body of the object, then, the flow function $\psi = \int \psi_1 d\sigma$ at point (ξ, η) of all vortex rings can be obtained. Here, $d\sigma$ is the length of the differential arc of the meridian.

At any point on the boundary surface of the body, the confluent function ψ_0 produced by the even on-coming flow and the series of vortex rings should equal zero to satisfy conditions of nonpermeability, i.e.,

$$\psi_0 = \psi_\infty + \int \psi_1 d\sigma = 0 \tag{4}$$

Inside the boundary surface, the condition of zero velocity of flow is naturally satisfied.

Substituting (1) and (2) into (4) and noting that $\Gamma = -U$, we have

$$\int_0^P K(\sigma, s)U(\sigma)d\sigma = \frac{1}{2}\eta^2(s) \tag{5}$$

This is the Fredholm integral equation of the first kind satisfied by the distribution of surface velocity of a flat-headed revolving body in axisymmetric flow. In the equation, P is the rear stationary point of the revolving body, arc length $\overset{\frown}{OP}$ is the semicircumference cross section of the meridian, σ is the integral variable, s is the integral parameter. All of them are the arc lengths along the meridian from the front stationary point. The kernel function $K(\sigma, S)$ is

$$K(\sigma,\ s)=\frac{\sqrt{y\eta}}{2\pi}\left\{\left(\frac{2}{k}-k\right)K(k)-\frac{2}{k}E(k)\right\} \qquad (6)$$

(III) Numerical Treatment of the Integral Equation

For a given flat-headed revolving body, we can solve the integral equation (5) using finite summation to approximate the integral terms of the equation. In this way, the integral equation can be substituted by a set of linear algebraic equations. However, when $x = \xi$, the modulus of the elliptical integral $K = 1$, the complete elliptical integral of the first kind has a logarithmic singularity, and the integrated function tends to infinity. Thus, the elliptical integral cannot be approximated by ordinary integral formulas, and it must be given special treatment. In addition, at the corner of the flat-headed body, the curvature of the geometric contour line of the body and the change in the velocity of the fluid are violent. Large values of velocity and pressure peak occur. In the circumfluous flow about such bodies, the results that people are most concerned about are often the magnitude and position of this peak value. Obviously, this is much more difficult than the problem of using axial distribution of singularities to treat ordinary round headed revolving bodies. Therefore, care must be taken in numerical treatment.

To facilitate numerical computation of the elliptical integral, the kernel function can be rewritten as

$$K(x,\ \xi)=\frac{\sqrt{(x-\xi)^2+(y+\eta)^2}}{2\pi}\left\{\left(1-\frac{k^2}{2}\right)K(k)-E(k)\right\}$$

Then the integral term in equation (5) is divided along the meridian into two spaces: (O,A) and A,P), i.e.,

$$\int_0^P K(\sigma,\ s)U(\sigma)d\sigma=\int_0^A K(\sigma,\ s)U(\sigma)d\sigma+\int_A^P K(\sigma,\ s)U(n)d\sigma \qquad (7)$$

The positions of A and P are shown in Figure 1. Point A is the upper endpoint of the radius of the flat-headed body and is also the starting point of the side surface of the cross section of the meridian. Point P is the rear stationary point.

The first term on the right side of equation (7) corresponds to the flat-headed portion of the revolving body, where $x = 0$, $\sigma = y$, thus

$$\int_0^A K(\sigma,\ s)U(\sigma)d\sigma=\int_0^A K(y,\ s)U(y)dy$$

The second term on the right side of equation (7) corresponds to the side surface portion. Here, $x = x(\sigma)$, $y = y(\sigma)$, and $d\sigma = dx/\cos\alpha$ where α is the tangent of the meridian and the angle between the tangent of the meridian and the axial line of the revolving body. By nondimensionalizing all linear measures against the total length of the revolving body, noting that $x = 0$ at point A and considering $\cos\alpha$ as a component of the kernel function, we have

$$\int_A^P K(\sigma, s)U(\sigma)d\sigma = \int_0^1 K_1(x, \xi)U(x)dx$$

where $$K_1(x, \xi) = \frac{K(x, \xi)}{\cos\alpha}$$

To approximate the integral term in the above equation, the entire integral space is divided into n subspaces, where the flat-headed portion is divided into m equal subspaces. In the part of the side surface where $x \leq 0.25$, the geometric shape of the body changes relatively greatly. Since this part is also connected to the flat-headed part, the change in velocity is extremely violent. Therefore spacing of the subspaces must adapt to this situation. For this we divided this part into 20 unequal subspaces and the terminal points of each subspace are:

$$x_i = \frac{0.0125(i-m)}{\exp\left\{0.85\left[1-\frac{(i-m)}{20}\right]\right\}} \qquad i = m+1,\ m+2,\ \cdots,\ m+20 \qquad (8)$$

In the range of $0.25 \leq x \leq 1$, there are $(n - m - 20)$ equal subspaces. Let the velocity U of the fluid in each subspace be a constant, then the controlling points of the velocity to be calculated are the midpoints of each subspace, i.e., where $x = 0$ on the flat-headed part:

$$\eta_i = \frac{(y_i + y_{i-1})}{2} \qquad i = 1,\ 2,\ \cdots,\ m \qquad (9)$$

and on the side surface

$$\xi_i = \frac{(x_i + x_{i-1})}{2} \qquad i = m+1,\ m+2,\ \cdots,\ n \qquad (10)$$

In this way, the integral term in equation (5) becomes

$$\int_0^P K(\sigma, s)U(\sigma)d\sigma = \sum_{j=1}^{n} U_j \int_{\sigma_{j-1}}^{\sigma_j} K(\sigma, s)d\sigma$$

$$= \sum_{j=1}^{n} h_{ij}U_j \qquad i = 1,\ 2,\ \cdots n$$

The integral in each of the subspaces

$$k_{ij} = \int_{a_{j-1}}^{a_j} K(a, s)\,da$$

is treated differently according to whether it contains a normal subspace in which $x \neq \xi$ ($\xi \in$ ...) or is a singular subspace in which $x = \xi$. The following method of treatment is similar to the method of treatment of the intensity about a source ring by an integral equation of the second kind expounded in reference (6).

In a normal subspace, the function being integrated is continuous and ordinary integral formulas can be applied directly to perform numerical integration. Here, the Simpson integral formula has been used for the computation. The required values of the physical shape and other geometric parameters are obtained from the interpolated values of the function of the sample strip. Depending on the magnitude of the moduli, different series expansion formulas are used for the elliptical integral in the integrated equation so that both the numerical precision of the elliptical integral and the rate of convergence of the series can be taken into consideration.

When $K^2 \leq 0.80$, we have

$$K = \frac{\pi}{2}\left\{1 + \left(\frac{1}{2}\right)^2 k^2 + \left(\frac{1\cdot 3}{2\cdot 4}\right)^2 k^4 + \cdots + \left[\frac{(2n-1)!!}{2^n \cdot n!}\right]^2 k^{2n} + \cdots\right. \tag{11}$$

$$E = \frac{\pi}{2}\left\{1 - \frac{1}{2^2} k^2 - \frac{1^2\cdot 3}{2^2\cdot 4^2} k^4 - \cdots - \left[\frac{(2n-1)!!}{2^n \cdot n!}\right]^2 \frac{k^{2n}}{2n-1} - \cdots\right. \tag{12}$$

When $K^2 > 0.80$, an auxiliary modulus K' is introduced, $K'^2 = 1 - K^2$, and we have

$$\begin{aligned} K = \ln\frac{4}{k'} &+ \left(\frac{1}{2}\right)^2\left(\ln\frac{4}{k'} - \frac{2}{1\cdot 2}\right)k'^2 + \left(\frac{1\cdot 3}{2\cdot 4}\right)^2\left(\ln\frac{4}{k'} - \frac{2}{1\cdot 2} - \frac{2}{3\cdot 4}\right)k'^4 \\ &+ \left(\frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\right)^2\left(\ln\frac{4}{k'} - \frac{2}{1\cdot 2} - \frac{2}{3\cdot 4} - \frac{2}{5\cdot 6}\right)k'^6 + \cdots \end{aligned} \tag{13}$$

$$\begin{aligned} E = 1 &+ \frac{1}{2}\left(\ln\frac{4}{k'} - \frac{1}{1\cdot 2}\right)k'^2 + \frac{1^2\cdot 3}{2^2\cdot 4}\left(\ln\frac{4}{k'} - \frac{2}{1\cdot 2} - \frac{1}{3\cdot 4}\right)k'^4 \\ &+ \frac{1^2\cdot 3^2\cdot 5}{2^2\cdot 4^2\cdot 6}\left(\ln\frac{4}{k'} - \frac{2}{1\cdot 2} - \frac{2}{3\cdot 4} - \frac{1}{5\cdot 6}\right)k'^6 + \cdots \end{aligned} \tag{14}$$

Reference to the series expressions (11)-(14) of the complete elliptical integrals of the first and second kinds can be found in reference 7.

In the singular subspaces, the complete elliptical integral of the first kind has a logarithmic singularity when $x = \xi$. The integrated function tends toward infinity. However, when $x \longrightarrow 0$, $\lim_{x \to 0}(x \cdot \lg x) \longrightarrow 0$. Therefore, the integral is integrable but it has to be approximated and estimated.

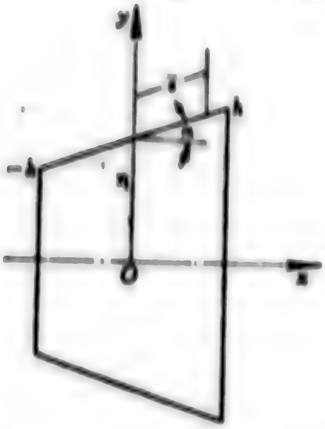

Figure 2. Singular subspace

The use of a frustrum of a cone with its top cut off to approximate and substitute for the shape of the revolving body inside the singular subspaces is illustrated in Figure 2. Let the velocity control point $\xi = 0$, η = constant, $x = \bar{s}\cos\alpha$, $y = \eta + \bar{s}\cdot\sin\alpha$, the nondimensional length the half width of the subspace is h, and $\bar{s}$ is the arc length from $\xi = 0$, then

$$k'^2 = 1 - \frac{4y\eta}{x^2 + (y+\eta)^2} = \frac{x^2 + (y-\eta)^2}{x^2 + (y+\eta)^2} = \frac{X^2}{4}\left(1 + \frac{4\sin\alpha\cdot X + X^2}{4}\right)^{-1}$$

$$= \frac{X^2}{4}\left[1 - \sin\alpha\cdot X + \left(\sin^2\alpha - \frac{1}{4}\right)X^2 + \cdots\right] \tag{15}$$

$$\ln\frac{4}{k'} = \ln\left(\frac{8\sqrt{1 + \frac{1}{4}(4\sin\alpha\cdot X + X^2)}}{X}\right)$$

$$= \ln\frac{8}{X} + \frac{1}{2}\sin\alpha\cdot X + \left(\frac{1}{8} - \frac{1}{4}\sin\alpha\right)X^2 - \frac{1}{8}\sin\alpha\cdot X^3 + \cdots \tag{16}$$

Substituting equations (15) and (16) into equations (13) and (14) we can obtain the approximation equations for K(k) and E(k), and by expanding the series corresponding to other factors of the integrated equations and noticing that the integral space is the symmetric space (-h, h) and the integrals of odd and even functions inside the symmetric space, we can obtain the series expansion formula of the kernel function inside the singular subspaces as follows:

On the side surface we have

$$k_{ii} = \frac{x_i - x_{i-1}}{2\cos\alpha_i}\left\{\left[1+\left(\frac{1}{16}-\frac{\sin^2\alpha_i}{24}\right)h_i^2\right]\ln\left(\frac{8}{h_i}\right)+\frac{5}{72}\sin^2\alpha_i\cdot h_i^2-1\right\} \qquad (17)$$

where $$h_i = \frac{x_i - x_{i-1}}{2\eta_i\cos\alpha_i}$$

and on the flat headed part, we have

$$k_{ii} = \frac{y_i - y_{i-1}}{2}\left\{\left(1+\frac{h_i^2}{48}\right)\ln\left(\frac{8}{h_i}\right)+\frac{5}{72}h_i^2-1\right\} \qquad (18)$$

where $$h_i = \frac{y_i - y_{i-1}}{2\eta_i}$$

Simply speaking, we have converted the integral equation (5) satisfied by the distribution of velocity into the following group of linear algebraic equations for solving the pressure distribution on the surface of the flat-headed revolving body:

$$\sum_{j=1}^{n} k_{ij}U_j = \frac{1}{2}\eta_i^2 \qquad i = 1,\ 2,\ \cdots,\ n \qquad (19)$$

The matrix coefficients k_{ij} of normal subspaces where $i \neq j$ can be determined by approximation using Simpson's integral formula. In singular subspaces where $i = j$, equations (17) and (18) are used to estimate the matrix coefficients. Then we use Landweber's method[8] of repeated substitution to solve the group of linear algebraic equations.[19] In accordance with the symbols we have used here, the formula of repeated substitution is:

$$U_{m+1,i} = U_{m,i} + \frac{1}{\sum\limits_j k_{ij}}\left(\frac{1}{2}\eta_i^2 - \sum_j k_{ij}U_{m,j}\right),$$

$$U_{0,i} = \frac{1}{2}\eta_i^2 \Big/ \sum_j^n k_{ij}$$

where m is the number of times of repetition.

The solution of the group of linear algebraic equations directly gives the distribution of the velocity U(x). Thus according to the Bernoulli theorems, the distribution of pressure on the surface of the flat-headed revolving body is:

$$C_p(x) = 1 - U^2(x) \qquad (20)$$

(IV) Numerical Examples

The above method of numerical treatment was written into a computer program and calculations were done for three flat-headed revolving bodies.

The results for Model (I) can be compared with data of wind tunnel pressure tests of that model. Models (II) and (III) are the objects (II) and (III) studied by Kershaw in Reference (3). The numerical values of the P shapes of the heads of the three models are listed in Tables 1-3. All linear measures are the values of nondimensionalized greatest radii of the body.

Table 1. Values of the Shape of the Head of Model (I)

x	0	0.09356	0.1684	0.3743	0.5614	0.7486	0.9356	1.1228	1.3099	1.6243	1.9985	2.3728	2.8069	3.9298	6.3810
y	0.6749	0.8499	0.8855	0.9128	0.9214	0.9278	0.9345	0.9409	0.9469	0.9560	0.9661	0.9747	0.9824	0.9901	1.000

Table 2. Values of the Shape of the Head of Model (II)

x	0	0.078	0.116	0.309	0.500	0.750	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	6.10
y	0.500	0.691	0.854	0.962	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3. Values of the Shape of the Head of Model (III)

x	0	0.001	0.003	0.007	0.013	0.020	0.028	0.037	0.046	0.189	0.332	0.477	0.767	1.059	1.352	1.500
y	0.750	0.760	0.770	0.780	0.788	0.796	0.802	0.807	0.810	0.840	0.876	0.907	0.952	0.983	0.998	1.00

The results of calculations are plotted in Figures 3-5. In the figure, the horizontal coordinate x in the first quadrant is the axial distance nondimensionalized against the total length of the revolving body as the characteristic length. The horizontal coordinate (y_0-y) in the second quadrant corresponds to the flat-headed part, where y_0 is the radius of the flat head. The origin of the coordinates $(y_0-y) = 0$ corresponds to the connecting point of the flat head and side surface, i.e., point A shown in Diagram 1. The point $(y_0-y) = y_0$ corresponds to the front stationary point, i.e., point 0 in Figure 1.

Figure 3 also shows the results of the wind tunnel pressure test of Model (I) conducted at the 708 Institute. The model was 2 feet long. The experimental data was provided by Comrade Qian Zaidi [6929 0961 2769] of the 705 Institute. Models (II) and (III) do not have experimental data. The figure shows the results of Kershaw's theoretical calculations[3] for comparison.

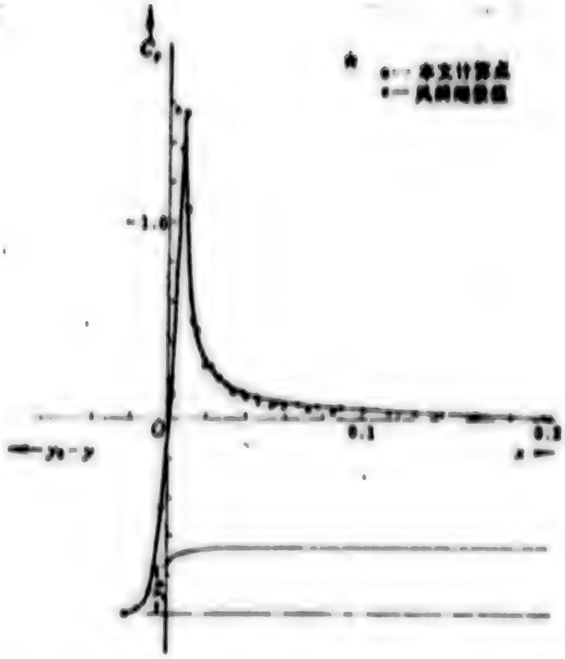

Figure 3. Linear shape of the head and distribution of pressure of Model (I)

Key: * · computed points of this article
x values measured in wind tunnel test

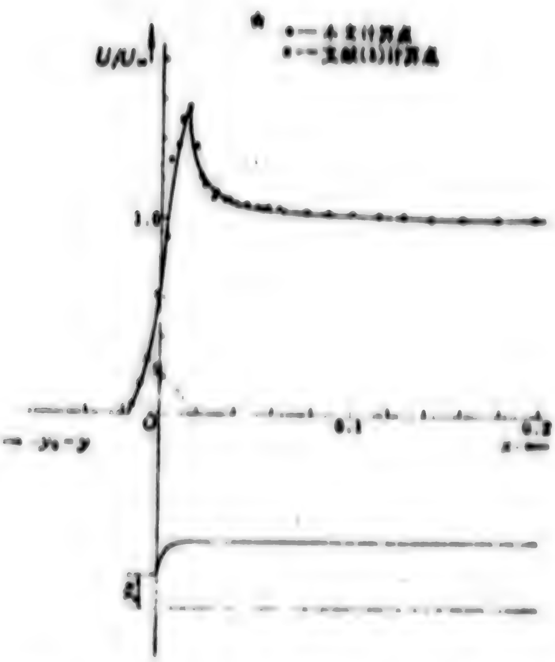

Figure 4. Linear shape and distribution of velocity of Model (II)

Key: * · computed points of this article
x computed points in reference[3]

(V) Conclusion

It can be seen from Figure 3 that for model (I), the computed pressure distribution and the experimentally measured pressure distribution coincide. For Model (II), the computed results of this article and of reference 3 are also basically the same. But for Model (III), the peak values of velocity calculated by the two theoretical methods differ to a larger extent. However, qualitative comparison of the magnitudes of the peak values of velocity of Model (II) and Model (III) and the foreward or backward leaning positions of the greatest velocities show that the computed results of the two theories are entirely consistent. Due to a lack of sufficient experimental data, the accuracy of the calculations of the two theoretical methods cannot be compared qualitatively. Of course, the computed results of this article and the data of the wind tunnel pressure test of Model (I) coincide very satisfactorily. But in treating objects

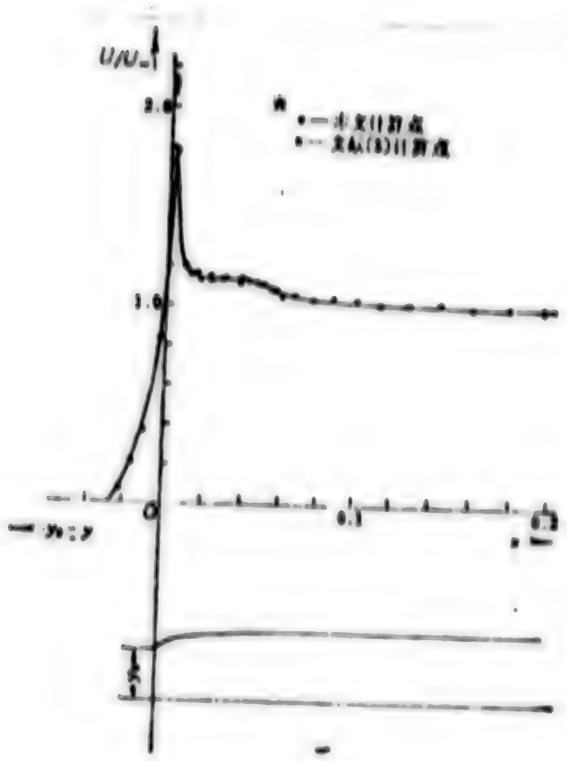

Figure 5. Linear shape of the head and distribution of velocity

* · computed points of this article
x computed points of reference

such as Model III which have a flat head of both a relatively large radius and curvature at the corners, the peak values of velocity are especially large, and numerical errors easily occur. Therefore, experimental data of only one model cannot fully evaluate the accuracy of a kind of computational method.

Summarizing the above, we obtain the following conclusion: The qualitative results of the theoretical method of computation of pressure distribution over a flat-headed revolving body is at least reliable. The reliability of its quantitative results and the scope of its applicability still require more experimental data for further substantiation.

REFERENCES

1. J.L. Hess, "Review of Integral Equation Techniques for Solving Potential Flow Problems with Emphasis on the Surface Source Method." "Computer Methods in Applied Mechanics and Engineering," 5,2, March, (1975).

2. R.I.A. Duffanlt and D.H. Henshaw, "Potential Flow Calculation for Arbitrary Axisymmetric Bodies." (AD 739742).

3. D. Kershaw, "A Numerical Solution of Integral Equation Satisfied by the Velocity Distribution Around a Body of Revolution in Axid Flow." (ARCR&M No 3308) (1961).

4. B. Thwaites, "Incompressible Aerodynamics." Oxford University Press (1960).

5. N.J. Kotschin, I.A. Kibel and N.W. Ross, Theoretische Hydromechanik, Vols I and II, Akademic-Verlag, Berlin 1954 (translated from Russian), Vol 1, Book 1, Higher Education Press.

6. W.A. Middleton, "Axisymmetric Turbulent Boundary-Layer Flow Determined with Only Body Geometry Known." (AD 290507) (1962)

7. Lei Rike [7191 2480 0344] et al: "Table of Functions and Table of Integrals," Higher Education Press, (1959)

8. L. Landweber, "Potential Flow About Bodies of Revolution and Symmetric Two-Dimensional Forms." (PB 152099) (1959).

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APPLIED SCIENCES

SYSTEMS ENGINEERING, RESEARCH TECHNIQUES DESCRIBED

Shanghai ZIRAN ZAZHI in Chinese Vol 3 No 1, Jan 80 pp 23-26

[Article by Wang Huijiong [3769 1979 3518], Yunnan Provincial Office of the Electric Power Industry: "Systems Engineering and Its Lines of Research"]

[Text] 1. The Basic Concepts of Systems and Systems Engineering

A. What Are Systems and Systems Engineering?

The term "system" is explained in various ways; below we summarize these explanations in two main categories.

(1) A system is a combination of people, equipment and processes organized to achieve a unified purpose. It produces its effects on the basis of certain principles. Its function is to accept information, energy and material, and in a certain time sequence to convert them into other types or levels of information, energy and material (including finished or semi-finished products made from materials).

(2) A system is an ordered arrangement of material or abstract objects.

On the basis of the first definition, we have various engineering systems and organization management systems; on the basis of the second, we have various natural systems and "systems thinking."

Systems engineering is, as the name implies, engineering which deals with systems. Mechanical and electrical engineering are kinds of engineering which have machinery and electricity respectively as their objects, while systems engineering does not take any special area as its object, but spans all specialties and studies in general form the overall design and operation of complex systems in order to realize the optimal effect from the whole. In its initial stage of development, it aimed at rapid application of new scientific and technical achievements in engineering design itself. But starting in the 1970's, its applications merged with industrial engineering. A system is a combination of various equipment, persons and processes, and these three factors are also intimately connected with and interact with the external surroundings. Systems engineering studies the interactions and interconnections of these aspects simultaneously at a given time. Another aspect of engineering is time-sequential relationships, and systems engineering studies the entire life-cycle of engineering, and studying the interconnections and interrelationships between the conceptual, planning, research, design, testing, manufacture, installation and utilization stages in an integrated fashion in order to achieve overall optimization of engineering and thus assure optimal ultimate quality of operation (utilization). Japanese investigators have extended systems engineering so that it transcends temporal and areal characteristics, making it an approach to overall quality management. Japanese investigators, and some Americans, trace the beginnings of systems engineering to Tyler's "Scientific Management" (1911).

B. Tools and Techniques of Systems Engineering

Because of the breadth of the subject of systems engineering, it has no fixed tools or techniques; systems workers use all tools which they consider appropriate, and continuously apply new science and technology to new systems. In general, their tools and techniques, apart from the specialized knowledge used in the study of specialized systems, include: conventional mathematics (i.e. the mathematics taught in engineering colleges in this country and abroad up until the 1950's, including differential equations, Laplace and Fourier transforms and the like), operations research (including linear programming, queueing theory, game theory, decision theory , statistics, planning methods, optimization methods and the like), probability theory, mathematical statistics, numerical methods, computer applications, engineering logic (including symbolic logic), cybernetics, human engineering, modeling techniques, simulation, experimental technique, engineering economics, management techniques, psychology and the like.

C. The Central Aspect of Systems Engineering: Methodology

Since systems engineering has the broad range of methods described above and must be used over a great expanse of time and space, its central problem is that of a set of approaches and methods. Since the early 1960's, such works as "Systems Philosophy" and "Methodology of Systems Engineering" have appeared abroad. The main approaches of systems engineering are three:

(1) It is necessary to establish a comprehensive outlook and not be led astray by partial or local phenomena, i.e. it is necessary to see the forest and not the trees.

(2) Different kinds of systems may show points in common as regards their functioning, time sequence or structure. The most important common characteristic was enumerated above: different systems all engage in the transformation of information, materials or energy.

(3) Different systems are all stratified. Their social value is determined by their structural position in the upper stratum. In order to understand the organization and characteristics of a system, it must be analyzed stratum from the top down, breaking it down into subsystems, sub-subsystems, components and parts, down to its basic constituent units: materials and forms (content and form).

In spite of more than 30 years of trying, it was not until 1974 that a definition of systems engineering appeared in an American scientific and technical lexicon; but in his paper "Systems Research Methodology," given at the 1975 International Automatic Control Federation conference, Pierre L. Faurre resolutely held to the foreign viewpoint of the early period: "Systems engineering cannot be defined in a few phrases; it would be best to describe it in terms of the tools and methods it uses." Of the various types of methodologies, we will examine three.

(1) Hall's methodology. The creator of the term "systems engineering," A. D. Hall of the Bell Telephone Company (USA), proposed a three-coordinate spatial structure. The X axis is the "logic" axis and includes definition of the problem, system objectives design, system synthesis, system analysis, optimization, decision making, implementation and the like. The Y axis is the "time" axis and includes planning stages, drafting programs, systems research and development, production, installation, operation, renovation and the like. The Z axis is the "knowledge" axis and includes law, economics, medicine and other such fields.

(2) The Chestnut method. Chestnut, of General Electric (USA), proposed a matrix method of expressing methods and tools. The columns include: the environment of the methods, organizations involved in systems engineering, planning and recording, formation and structure, value determination, prices, time, reliability. The rows include: energy, materials, information, model making, computation, control, probability and statistics, signals and noise, optimization, deviation and error, and the like.

(3) In his book "Introduction to Systems Engineering" [Xitong gongchengxue daolun], the present author included the concrete engineering employment of certain logical and union-of-opposites concepts such as abstraction (setting up of models), generalization, comparison, synthesis and analysis, inference and demonstration, cause and effect, content and form, chance and necessity, and engineering material and quality under the rubric "systems engineering methodology."

D. Characteristics of the Objects of Study of Systems Engineering

The objects of study of systems engineering are the optimal planning, management and operation of complex systems. They have the following characteristics and requirements:

(1) Systems are composed of different parts and many kinds of largely similar parts. They are assemblages of large numbers of working components.

(2) The main working components of systems (including people) can manifest similar functions in different systems.

(3) Systems are manmade and controllable by man, a statement which ignores natural systems, although in recent years the trend of foreign systems engineering has been to include natural systems.

(4) The components of systems interact with both other components and the surroundings. Their interaction is multiply stratified. Analyzing this interaction and suitably distinguishing the strata are important tasks of systems engineering functional analysis.

(5) Systems engineering should be integral in nature. The parts are combined in order to make the system carry out overall purposeful optimization and produce the optimal output from a certain input. Making a combination of components into the best-adjusted synthesis is an important task of the synthetic function of systems research.

(6) Systems are semiautomatic: people and computers perform their respective proper functions in a system. This makes human engineering and computer applications into important fundamental aspects of systems engineering.

(7) Systems inputs are random, and as a consequence it is impossible to predict correctly the characteristics of a system at any given moment. In certain automated processes, although it is possible to predict the input rate, during the design there still exists the difficulty that it is impossible to predict changes in surroundings and starting materials precisely. This makes probability and mathematical statistics essential tools for work with systems.

(8) Some systems have a competitive nature, such as military systems in which one side tries to destroy or weaken the effectiveness of the other. This gives game theory a rather important place among the foundations of systems engineering.

Above I have summarized the characteristics of objects of study of systems research, as well as some ideas that systems engineering experts should have in mind when they study different systems.

2. Temporal Background, Development, and Current Significance

The development of any branch of science and technology has a certain temporal background and reflects the needs and possibilities of the age. For example, mankind first had to solve the problems of food, clothing and shelter, and accordingly mastered weaving, farming and building rather early. At the beginning of capitalism, in order to solve the problem of removing water that had flooded coal pits, England in 1705 brought forth the Newcomen steam engine. In 1782 Watt made rather high-quality improvements in it, making it a new source of motive power. In the mid-18th century, the Aidisheng [phonetic] Institute was founded, bringing scientists from individual labor into collective, cooperative research. The scientific research and application cycle has rapidly shortened. Starting in the 1940's, natural and applied science began to develop extremely rapidly in two directions: one was the development of fields with rather narrow specialization, such as polymer theory; the other was development in breadth and applicability to a wide range of subjects, as exemplified by cybernetics and dimensional theory. Systems engineering is in the latter category. It originated because in recent years the scale and complexity of engineering had been increasing steadily and specialization had been growing, creating the necessity for intensified study of coordination in the engineering field as a whole. Joseph J. Jerger gives the following simple definition of systems engineering: "Guided missile technology is the most complex area of military technology. It embraces almost all the physical sciences, and requires collaboration between a wide variety of specialists and highly trained engineers. In order to achieve good results, it is necessary to have effective coordination and to provide the collective of engineers with technical guidance: this is called systems engineering." Although this is an extremely rough definition of systems engineering, it does reveal the temporal background of the emergence of systems engineering.

Systems engineering had its origins in 1930 when the American Leide [7191 1795] Corporation developed the "systems approach" in developing television broadcasting. During World War II, many operations research organizations furnished philosophical viewpoints and techniques (after the war, many operations researchers went from the military into consumer industries). In 1946, the United States Air Force elaborated the "systems philosophy: concept at the Leide Corporation. In the early 1940's Bell Laboratories was the first organization to use the term "systems engineering." In the 1950's and 1960's, courses in "engineering design and analysis" given at British, America and other universities aided in the development of systems engineering. In 1957, the first book entitled "Systems Engineering Handbook" appeared in 1965. Now, all scientifically and technically developed nations are engaged in systems engineering research which extends to every field. This is because in modern society, whose productive forces are highly developed, specialization and integrated cooperation are two inseparable aspects. In dealing with new complex subjects and requirements, traditional specialized engineering courses could not adapt. Accordingly, the development of systems engineering reflected the complex needs of the age. Currently this country is moving towards the four modernizations; when it stresses specialization in the physical reform, it must not neglect the other aspect of integrated coordination, for this is the best way to faster implementation of the four modernizations.

3. How Should Our Country Develop Its Systems Engineering Research?

In 1978, systems engineering was included among this country's key research areas. I have two personal suggestions for development of research and application of this field.

A. The "systems engineering" method and viewpoint should be used to pursue systems engineering research.

Section 2 of this paper discussed the methodology of systems engineering. The process of developing systems engineering research can be divided into three stages. The following circumstances must be borne in mind in these three stages:

(1) Defining the problem. It is necessary to analyze the environmental factors which will foster systems engineering research. Only by making a thorough collection of all kinds of foreign materials on systems engineering dating from different periods can we resolve future conflicts of viewpoints in this country on systems engineering. We should concentrate our still limited systems engineering manpower and effectively strive towards an objective.

(2) We should formulate the objectives of employing "systems engineering." To develop systems engineering research successfully in this country, in addition to theory we have an urgent need to gain knowledge from practice and applications. In order to apply systems engineering, we must analyze this country's current situation and needs and formulate the objectives for its application. On the basis of the current situation in this country, systems engineering will have a broad area of application. The integrated departments in the state machinery, planning and design, management research, rational energy resource development, military affairs, electric power, posts and telecommunications, communications systems and the like all have extensive areas for its application and practice.

(3) Implement and develop planning. The PERT system can be used to determine and control objective and progress at all stages.

B. We must overcome the traditional educational prejudice in favor of "specialization" and expand our field of vision if we are to correctly understand systems engineering.

During and after the World War II, the interpenetration of various fields became the distinguishing characteristic of science and technology. Accordingly, Wiener, the originator of cybernetics, suggested: "If the difficulties of biological research are primarily mathematical in nature, ten biologists who have neglected mathematics will have only the same effect as one biologist who has neglected mathematics."

In his "Dialectics of Nature," Engels pointed out: "Every age's theoretical ideas, and accordingly this age's theoretical ideas as well, are a historical product. In different historical agres they have extremely different form, and accordingly also have extremely different content. As a result, the science of thought, like any other science, is a historical science, the science of the historical development of human thought." (1971 Renmin Publishers edition, p 27). If we understand the points above, if we understand the changes that have occurred across the length and breadth of science and technology worldwide since the 1940's and 1950's, we will be able to understand that the emergence of "systems engineering" is a product of the necessities of the age. Only when our thought can adjust to this circumstance will we be able to eliminate the prejudice of "specialization," take a correct path of development and successfully pursue systems engineering research in this country.

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LARGE SCALE SYSTEMS, DECENTRALIZED CONTROL DISCUSSED

Shanghai ZIRAN ZAZHI in Chinese Vol 3 No 1, Jan 80 pp 26-28

[Article by Hu Baosheng [5170 0202 3932], Institute of Systems Engineering, Jiaotong University, Xian: "Large Scale Systems and Their Decentralized Control"]

[Text] 1. Definition of Large Scale Systems

Large scale systems have already become a research subject to which scientists in many countries are paying serious attention. What is a large scale system? Thus far there is no precise definition which is universally accepted and is widely felt to be satisfactory. From the viewpoints and methods of expert discussions of the definition of large scale systems since 1974 in this country and abroad we can derive the following six categories:

A. Simple avoidance of a definition and use of examples to indicate what a large scale system is. Reference 1, for example, cites seven examples including power networks, municipal communications networks, digital communications networks and complex engineering systems as examples of large scale systems.

B. Explanation of large scale systems by comparison with traditional small scale systems. Reference 2 points out that large scale systems differ from small scale systems in the following six ways:

(1) more than one control organ and decision maker (organ) leading to the use of decentralized calculations;

(2) the control organs use appropriate, different information, and may be in operation at different times;

(3) the various control organs have a need for coordination when in operation, resulting in a multilevel stratified structure;

(4) only aggregated (composite) and very imprecise models can be used;

(5) systems can operate in subordinative fashion or in a state of fundamental contradiction, and accordingly there can be single-objective formulas, multi-objective formulas or conflicting-objective formulas;

(6) it may be more reasonable to use "satisfaction" tactics rather than optimization tactics.

C. In terms of models, a system whose input-output behavior cannot be understood except by simplifying and dividing into several modules or by aggregating modular subsystems is a large scale system[3].

D. Across-the-board use of structural complexity to make the distinction. As pointed out by reference 4, the term "large scale system" applies to all control and information systems which are on a large scale and have a complex structure; reference 5 takes a similar approach but adds the condition of numerous influences; reference 6 states that when a dynamic system has a certain degree of complexity in terms of structure or dimensions it is a large scale system; reference 3 states that when a system exceeds the structural capabilities of a simple control system it is a large system, and so on.

E. Distinction through the opposing concepts of "partial" and "total." A. Ya. Lerner believes that the term "large scale system" is used in comparison with that of the ordinary partial system; a partial system (i.e. a small scale system) is a component of a large scale system.

F. Distinction in terms of whether the system involves (includes) human understanding, judgment and planning. Reference 7 states that in addition to large scale and complexity, a large scale system must include the man-machine factor.

The present author believes that of the above definitions of a large scale system, some simply lay hold of one or a few attributes, some are too sweeping, and some add so many interpretations that they become too complex to win general acceptance.

How, then, are we to define or understand large scale systems?

In the author's view, a large scale system can be defined as: a system of things (or links or subprocesses) with an intricate cause-effect relationship which during the development of human history people have had to set up in order to handle social (e.g. war, economics, political, education and the like), production, scientific, technical, research and other such tasks. Moreover this system of things must also be subject to certain constraints and be encompassed by influences and interference from other factors. Our task is to study and grasp the overall processes of operation of these kinds of systems.

The author believes that in defining a large scale system, we must take into account not only spatial, temporal and interactional size and complexity but also the fact that a large scale system generally includes the intersection and interpenetration of elements from several areas (particularly the economic and technical areas). Moreover, we must at all costs avoid being fettered or affected by systems concepts applying to the study of small scale systems and stemming from automatic control and economic management. For example, the automatic control area generally deals with technical, engineering or physical systems, and the effects (or measures) imposed on systems are called "control"; while in the economic area (and in the social, political and other superstructures), the term "system" is not used, and the application of measures is called "management." In reality, the terms "control" and "management" have similar meanings, and it is only because of the fact that they come from different fields that the terms used differ.

The difference between large scale and small scale systems is that: typical small scale systems generally only effect control of only one key factor (or parameter) of the whole; and when they are expanded to control of several key factors (so-called "multivariate control systems") these systems have an essentially partial nature; and the thing controlled by large scale systems generally involve an index of the overall capabilities of the total system (or a combination of several indices), and it is generally necessary to take several control measures; the scale of systems can include whole plants, cities or countries, or even many thousands of plants, several countries of the entire world; the breadth of systems can encompass political, economic, production, science and technology, as well as tasks with different objectives in planning, design, construction, organization, management and control.

2. What Name Should Be Given to the Science of Large Scale Systems?

After studying the definition of large scale systems, the question which we naturally wish to answer next is what we should call the study of these large scale systems. People with experience in or an inclination toward automatic control work naturally advocate calling it "systems engineering." Others consider that it is only a "way of thinking" and advocate calling it "systems methodology." Still others believe that it is a technical science, while yet another group believes that it can only be considered an engineering techique. In addition, some advocate calling it "management science," or "decision-making science." To a considerable degree, these different suggestions reflect prejudices stemming from the historical development of the different sciences and technologies. Objectively, a true large scale system generally are interconnected and interact. The breadth and the interacting of the area encompassed by large scale systems naturally cannot be rigidly confined to purely engineering or physical large scale systems of purely management-type economic systems. At present a large engineering or scientific-technical system must involve various concepts and problems of the traditional management field, while a modern large scale economic or social system must also involve various phenomena and problems of rigid, "mechanical" systems, because these rigid systems, such as communications systems and electronic data processing systems, have already become fundamental tools of managers. Accordingly it is unnecessary for each party to stick to his own view. The problem is to further integrate existing knowledge and results from the traditional control and management areas, and while continuously implementing, summarizing and improving large scale systems, to create a fresh technical science of large scale systems which the writer considers might well be correctly called "system science." It may be thought that the "system science" which studies large scale systems is already taking shape. When we use the common knowledge of "systems science" to explain the practice of specific systems, we call it "systems engineering."

The tasks to be performed by the "systems science" which studies the common problems of large systems can be classified in six large groups according to their character: (1) overall planning and coordination; (2) design; (3) management; (4) control; (5) operation and maintenance (including (construction and the like); and (6) multiobjective gaming (multiperson game theory).

The main content of system science is as follows:

A. Structural analysis, modeling and recognition of large systems (all lumped together under the term "modeling").

B. Investigation of characteristic features of large scale systems such as stability, controllability, observability, degree of controllability, strength, sensitivity and reliability, including how to recognize and express these characteristics and methods of changing them.

C. Optimization, suboptimalization, decision-making and rational control in large scale systems. Here control is used in the broad sense, including common problems of carrying out tasks of different types in the above-mentioned six categories, such as multilayer stratified control of large scale systems, decentralized control, and various optimization methods. When existing linear and nonlinear programming, the maximum principle and dynamic programming, network chart methods (GERT, PERT and the like) and other optimization methods are extended to the study of large scale systems, they all come under this category.

D. Modeling, simulation and solution of large scale systems. The main tool for modeling of large scale systems is the electronic computer, including digital and hybrid types.

3. Decentralized Control of Large Systems

Hitherto it has generally been believed that large scale systems have two basic types of structure, stratified and decentralized. Research on stratified systems began a little earlier and has been done in larger quantities. Reference 3 summarizes research results already obtained in the study of stratified systems. But the study of decentralized systems has lagged somewhat behind and is less mature, so that it is relatively difficult to summarize existing research results[8]. Here we will give a simple introduction to problems of the control of decentralized large scale systems.

First, why do we mention the necessity of decentralized control of large systems? What is the need to do so? This is primarily because objectively, large scale systems naturally involve geographical (i.e. spatial) expanse and dispersion. For these systems, artificial use of a centralized control scheme is completely irrational, and economically disadvantageous as well. Because of the increasing cost of investment in information transmission channels (amounting to as much as 50-60 percent of total control costs), and the resulting decrease in reliability of centralized control schemes. In reality centralized control schemes were a necessity only in the early days when computers were still relatively expensive. As large scale integrated circuit technology developed and computer costs fell, multilayered control systems embodying a combination of centralization and decentralization became feasible, and this kind of multilayered structure reflected an objectively existing kind of multilayered structure in large scale systems; chemical and steel associations are large scale systems of this type. But in reality there is a type of large scale system which has an entirely decentralized structure, exemplified by electrical power networks, municipal communications networks, digital communications systems, ecological systems, large scale economic systems and the like. For such decentralized-structure systems, the reasonable approach is clearly to use decentralized control. The appearance of cheap microprocessors and microcomputers provided a technical guarantee of their implementation.

Second, what is meant by "decentralized control"? Decentralized control of a large scale system means using individual local control organs to control a large scale system according to the distribution of its subsystems. If all of the local control organs lack any information exchange, this is called completely decentralized control; but if there is partial exchange of information (main and key information) between the local control organs, this is called partially decentralized control. When there is an additional coordinating organ to coordinate the work of the various local control organizations, this is called multilevel control. Here we will take the control of the traffic signals at the intersections along Yan'an Road in Shanghai as an example to explain the nature of a simple kind of decentralized control. If the control organs for the signals at these intersections were controlled only in terms of local conditions, it would be completely decentralized control, and if all of the control organs exchanged information on local traffic movements on the neighboring streets, this would be partially decentralized control. The general task of this kind of main-road traffic control is maintenance of normal free traffic flow with minimal passage time and waiting time, and thus minimal energy expended in waiting. To achieve this end, if we use a completely decentralized control program, we must know the statistical laws governing traffic flow at different times of day, which means we must determine a mathematical model for the signal throughout the day, after which we can use this model to formulate a control program for the system and the control rules to be assigned to the individual partial control organs. It can be seen from this simple example that the more complete our understanding of the system and knowledge of the model, the more conducive to achieving optimal control design; and when a system cannot be precisely understood (or correctly modeled), completely decentralized control can only achieve suboptimality. As the model becomes coarser, to achieve optimal control it becomes essential to have the individual partial control elements exchange necessary information. But if we use the simplest completely decentralized control, under many circumstances we can still attain relatively good control effects. For example, Shanghai experimentally installed simple fixed time cycle control only at the intersection of Yan'an and Xizang Roads. Traffic flow levels at different times of day on the two streets were divided into 6-10 stages (on the basis of statistical data). For example, before 8:00 am every day, the green light was on for Yan'an Road for 40 seconds and for Xizang Road for 30 seconds; between 8:00 and 11:00 am the light was green for Yan'an Road for 60 seconds and for Xizang Road for 50 seconds, and so on; after 9:00 pm, the green light on Yan'an Road was turned on by a sensor unit only when an automobile approached. Simply by using this experimental approach, the throughput of the intersection was increased by a third. At peak traffic hours, the waiting time for mechanical vehicles decreased from a maximum of 4 minutes to under 2 minutes. It can be seen from this that by further implementing large scale system decentralized control at the main intersections, even more noteworthy results could be achieved.

It must be pointed out that decentralized control is not used solely in spatially and temporally decentralized large scale systems. Sometimes in spatially highly centralized systems, if the dynamic reaction times (or time constants) for individual control channels show large variations, decentralized controls can be applied to them. For example, the decentralized control approach can be adopted for pneumatic control surfaces for aircraft position and average speed, slow vibration modes, short-period modes, turning modes (preventing structural stress from exceeding the limit) and avoiding vibration peaks.

4. Difficulties of Decentralized Control; Research Approaches

Currently, in designing large systems with decentralized control there are many problems awaiting study and solution, some of the main ones are as follows:

A. In circumstances where the number, structure and connections of decentralized control organs are not determined in advance, how can an optimal decentralization solution be achieved? New methods will be required for solution of this problem.

B. Because of the nonclassical information structure of decentralized control (i.e. the individual partial control organs do not receive measurements and decision made by other control organs), there can arise two main difficulties: sending tactics and second-guessing phenomena.

The problem of sending tactics means, in direct observation terms, that if any communications channel between decentralized control organs breaks down, if centralized theory is applied extremely nonlinear coding situations can arise in the other information channels. The dynamic system itself may have to function as a channel, but large scale system dynamics generally are poorly determined because of the extreme coarseness of the model, so that planning to use the system dynamics as a channel to transmit the omitted information is meaningless in engineering terms.

In second-guessing, if Karman-type [Ka'erman 0595 1422 2581] wave filtering estimation of state variables is used, when a given partial (decentralized), Karman wave filter is estimating some partial state variable, the estimated value not only is affected by the local control decisions, but also is controlled by the other decentralized control organs. Accordingly, this partial Karman wave filter strives to estimate the control signals sent by other control organs, and these control signals in turn are dependent on this particular Karman wave filter's best estimate of the state variable, so that a deadlock situation is produced.

So far we do not know how to analyze and solve mathematically such problems as sending tactics and second guessing phenomena.

C. When we have determined that a large-scale system is separable in its time scale or that the individual subsystems have weak dynamic coupling, we can employ decentralized theory to solve the problem of its decentralized structure. But when this is not the case (which happens often) the problem of how to select the structure of the decentralized system is as yet an unsolved one.

D. The problem of modeling decentralized large scale systems is not as yet satisfactorily solved.

To sum up, the theory of decentralized control of large scale systems has not yet been satisfactorily established, and many questions and a large amount of work await systems scientists. Of the areas and topics which now most urgently require study, we may mention at least the following:

A. Use of existing theoretical results and new concepts and methods to study approaches to the information and decision making structure in decentralization of large-scale systems.

B. Research on ways of modeling large scale decentralized systems and ways of simplifying the models, as well as ways of comparing models obtained by different methods.

C. Analysis and simulation studies of the information channels and information of different decentralized control organs (such as information form, lag, random loss of effectiveness and the like), and consideration of the information channels as important components of the overall system, including the study of how to avoid nonlinear sending tactics and second-guessing phenomena.

D. Investigation of the optimization of decentralized control systems (including static optimization and dynamic optimization and suboptimization of form), and of the theory and methods of rational control.

E. Investigation of the control theory of decentralized large scale systems under random influences.

F. Practical work in decentralized control of various types of large scale systems, accumulation of experience, summarization and improvement, discovery and creation of new concepts, theories and methods.

Of course, it is also necessary for us to make an effort to rapidly master results that have been published abroad, to put them into practice and to catch up.

BIBLIOGRAPHY

1. Athans, M. "Proceedings of IFAC Congress" (1978), 2371.

2. Ho, Y. C., and Mitter, S. K., eds. "Directions in Large-Scale Systems (Many-Person Optimization and Decentralized Control)," 1975.

3. Mahmoud, M. S. IEEE TRANS. ON SYSTEMS, MAN AND CYBERNETICS, SMC-7, 3 (1977).

4. Tu Xuyan [3205 1645 1750]. ZIDONGHUA [AUTOMATION], 1, 1, 12 (1977).

5. Qian Xuesen [6929 1331 2773]; Xu Guozhi; and Wang Shouyun. WEN HUI BAO, 27 September 1978.

6. Michel, A. N., and Miller, R. K. "Qualitative Analysis of Large Scale Dynamical Systems" (1977), Academic Press.

7. Wymore, A. W. "Systems Engineering Methodology for Interdisciplinary Teams" (1976), John Wiley and Sons.

8. Sandell, N. R., Jr.; Varaiya, P.; Athans, M.; and Safonov, M. G. IEEE TRANS. ON AUTOMATIC CONTROL, AC-23, 2 (1978).

9480
CSO: 4008

COMPUTER CENTER ESTABLISHED IN NEI MONGGOL

Beijing GUANGMING RIBAO in Chinese 11 May 80   2

[Text] In order to develop computer use among the borderland minority districts, Nei Monggol has set up a computer center for the autonomous region in Huhehot.

The Nei Monggol Computer Center was originally a computation station, preparation for whose construction began in 1975, with formal operations beginning in 1976. At the time, the Guiyuan Autonomous Region Office of Science and Technology was in charge of it. It focused on services, doing solely scientific and technical computations, and serviced a relatively narrow area. Some time ago, in accordance with the requirement for planning and coordination of the use of computers, the autonomous region's Committee on Science brought thoroughly into play the effective use of computers and changed the computation station into a computer center subordinate to the committee. After establishment of the computer center, computer applications for the entire autonomous region were unified and coordinated; the previous exclusive service orientation was altered, and research and service were gradually made coequal. The scope of the service aspect is being expanded and for this purpose the computer center recently held a large-scale technical demonstration.

After its founding, the Nei Monggol Computer Center, in cooperation with the relevant units, held more than 10 short training classes in Hohehot, Baodou and elsewhere and trained nearly a thousand technical personnel already employed, extensively popularized computation terminology, programming and computation methods, and sent scientific and technical personnel to teach applied computer courses at workers' spare time universities. They also accepted specialized teachers and students from such institutions of higher education as the Nei Monggol University and the Normal Academy, Agricultural and Livestock Raising Academy and Forestry Academy for training, and arranged hands-on training for the computer terminology classes of the nationwide geological systems held by the Central Office of Geology.

8480
CSO: 4008

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

CHINA BIOPHYSICS SOCIETY ESTABLISHED

Beijing GUANGMING RIBAO in Chinese 13 May 80 p 2

[Text] The China Biophysics Society has been formally established. The inaugural meeting was held between 4 and 9 May in Beijing.

Biophysics is a science which studies the physical laws of life phenomena. It is a product of the union of biological and modern physical theory and techniques. The development of research in this field will be important in furthering the development of fundamental biological and physical theory, solution of problems in industrial and agricultural medicine and national defense development, and accelerating implementation of the four modernizations. Research already underway in this country includes molecular biophysics, cell biophysics, radiation biophysics, functional biophysics, theoretical biophysics, biological information and control theory, the physical nature of biological organization, and biological engineering.

Nearly 200 representatives of more than 80 units in this country participated in the inaugural meeting. Bei Shizhang [6296 2514 3864] was elected director. The main session also reserved places on the board of directors for our biophysics colleagues from Taiwan Province, and will welcome them to the mainland part of our homeland for scientific exchange. During the meetings, the Third National Biophysics Conference was also held, and more than 300 technical papers were exchanged. The conference also altered the previous practice of having every paper read and increased the use of scientific wall newspapers to discuss this method of information interchange, which enables the representatives to systematically read the papers which interest them and have free face-to-face discussion with their authors, greatly enlivening the scholarly atmosphere.

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CSO: 4008

AUTHOR: SHUI Qingzhao [4451 3237 0508]
ZHAO Guanqian [6392 0385 6197]
FENG Lifang [7458 0448 5364]
XU Lizhen [1776 7787 3791]
BAN Zhuo [3803 8743]

ORG: None

TITLE: "Comments on the Countrywide Competition of Design Projects for Urban Housing (1979)"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 1-7

TEXT OF ENGLISH ABSTRACT: The countrywide competition of design projects for urban housing jointly sponsored by the Architectural Society of China and the State General Bureau of Building Construction was held from 30 Nov to 8 Dec in Beijing. Out of 151 projects submitted by 29 provinces, municipalities, and autonomous regions, 50 projects were awarded or recommended. The competition has reflected the following features: (1) Sufficient attention has been paid to satisfying the functional demands, such as good orientation, through ventilation, natural lighting, and so on. Balconies and built-in closets and storage cupboards have been provided. (2) Great care has been taken in relation to the problem of standardization so as to raise the degree of building

[continuation of JIANZHU XUEBAO No 2, 80 pp 107]

industrialization. Most projects have employed unified or enlarged modules and not more than 3 to 4 parameters. (3) Many projects have attached importance to saving land. Trials have been made in enlarging the depth of the building and reducing frontage width. Moreover, attention has also been paid to the application of new technology and anti-seismic problem.

AUTHOR: None

ORG: None

TITLE: "Develop Design Competition to Contribute to Residential Construction"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 8-9

ABSTRACT: The 1979 nationwide design competition of urban housing jointly sponsored by the Architectural Society of China and the State General Bureau of Building Construction produced 7 first prizes, 13 second prizes, and 30 third prizes, according to the announcement of 8 Dec 79. The Central Party is extremely concerned with the problem of housing for the masses. Aside from the province of Taiwan, the Architectural Societies of 29 provinces, cities, and autonomous regions received more than 7,000 design projects in the competition, the greatest scale since the beginning of the nation. Out of these, the local societies recommended 151 designs to participate in the national competition. Winners of the first, second, and third prizes are given in a table in this paper.

AUTHOR: LIN Jiang [5259 3068]

ORG: None

TITLE: "Design of the White Swan Hotel"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 10-15

TEXT OF ENGLISH ABSTRACT: The White Swan Hotel is located to the south of Shamian in Guangzhou. The site, 600 meters in length and from 50 to 80 meters in width, is wrested from a former beach of the Zhujiang River through the building of a dike. Its eastern part is left for landscaping and the rest is devoted to the hotel with a total area of 30, 000 square meters. The building group includes a main block with an accommodation of as many as 1,000 guest rooms and all those facilities, such as shops, a post office, a bank, and restaurants of various kinds, as well as an outdoor swimming pool, a gymnasium, etc. Now the piling of the main block is under construction.

In the general layout, easy accessibility for motorcars and service vehicles and segregation of noise from the bustling streets have been sufficiently considered. The main block is placed on the northeastern part of the site, and most of the passengers can gain access to it by an elevated bridge which

[continuation of JIANZHU XUEBAO No 2, 80 pp 10-15]

leads directly to the east main entrance on the first floor. A north subsidiary entrance for staff members is on the ground floor.

The design adopts a combination of high-rise with low-rise buildings. The main block is of 25 stories, whereas the shops, restaurants, lounges, convention rooms, etc. are housed in low-rise buildings, which are placed to the south of the main block and command a fine view of the Zhujiang River. Ancillary buildings containing service facilities and mechanical installations are concentrated on the northwestern part of the site.

The main block is planned in the shape of a rhombus, with 40 guest rooms on each floor around the north and south sides and a lift and service core in the center. The vertical mass of the main block contrasts strikingly with the low buildings and the horizontal approach to the elevated bridge.

In the general layout, a system of traditional courtyard planning has been used, and the progression of spaces produces a rhythmic alternation of solids and voids along an axis through the narrow, oblong site from east to west. Around the atrium, which is composed of a pond, rocks, and greenery, are arranged entrance halls, restaurants, shops, and convention rooms. To the west of the restaurants, there is a large-sized garden with a lake, lawns, and groves as well as pavilions and covered corridors. On the south is a dike, planted with banyan trees, which forms a spatial transition between the garden and the natural setting.

[continuation of JIANZHU XUEBAO No 2, 80 pp 10-15]

In the design of the main block, the traffic lines of the guests and the service should never cross is thoroughly observed. Special attention has been paid to the application of traditional style in the interior decoration, such as using wooden lattice screen to subdivide spaces.

AUTHOR: ZHU Shanquan [2612 1472 2164]
LIN Kaiqu [2651 7030 2976]
QI Zhenya [7871 2182 0068]

ORG: All of Beijing Municipal Construction Designing Academy

TITLE: "The People's Palace of the Republic of Zaire"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 16-20

TEXT OF ENGLISH ABSTRACT: Situated in the new civic center of the capital Kinshasa, the People's Palace of Zaire was set up especially to cater to the needs of domestic and international conventions as well as mass rallies. The site covers 18 hectares and the total floor area amounts to 40,000 square meters. The palace was designed by Chinese architects in collaboration with the Kinshasa city planning departments and interior decorators from several regions of Zaire. The construction was completed in May, 1979.

The palace stands on the comparatively high northern part of the site with an open space on the south, and faces a civic square and a main street 80 meters in width. The building employs a symmetrical composition and combines with gardens and courtyards to form interpenetration of indoor and outdoor spaces. In the center of the internal square in front of the palace there is a fountain 45 meters in diameter with greenish mosaic pavement. In the fountain, are arranged 9 leaf-like plates, made of concrete symbolizing the unity of all nationalities of Zaire. The fountain is installed with underwater color lighting. Flanking the square are 120 flagstaffs and lawns as well as parking spaces for 500 limousines.

[continuation of JIANZHU XUEBAO No 2, 80 pp 16-20]

The palace is 185 meters long from east to west and 102 meters wide from north to south, with a total height of 34 meters. It is of 4 stories. In the center of the first floor, there is a flight of 40-meter long granite steps, and a colonnade composed of 32 columns faced with white marble stands on a large terrace 5 meters in width and about 150 meters in length. On the east and west elevations the front and back wings are connected by covered corridors. All external walls are finished with white cement plaster in contrast with bluish vertical sun-breakers made of precast concrete.

A spacious foyer 65 meters long and 25 meters wide leads to a convention hall with a seating capacity of 3,500. The second floor contains a 800-seat cinema and a 600-seat banquet hall on the east and west front wings respectively. An international convention hall accommodating 475 persons is on the third floor. Zaire has rich resources in copper. The gable roof of the palace is covered with copper sheets; in the foyer there are decorations made of bronze with designs in traditional style. The capitals of the wooden columns in the cinema are made of black hardwood carved with geometrical patterns derived from ancient art.

AUTHOR: CHEN Dengao [7115 4098 7663]
LIU Hongqing [0491 1347 1987]
LIU Kaiji [0491 7030 3444]

ORG: None

TITLE: "National Style of Arabic Yemen Architecture"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 21-25

ABSTRACT: Toward the end of summer and the beginning of autumn last year, the authors accepted the job of designing the international conference building of Yemen Arab Republic. They went to Yemen to gather related data and gain understanding concerning the love of the local people for architectural style. The data collected include a portion concerning local ancient structures and a portion concerning modern structures. On the basis of these data, this paper attempts to introduce a preliminary analysis of the architectural characteristics and the process, intended by the authors, to absorb the traditional architectural style in the attempted design. This paper includes many photos depicting existing buildings of traditional as well as modern styles and 2 views of the semi-finished design of the international conference building proposed by the authors.

AUTHOR: LIU Zhenya [0491 2182 0068]

ORG: Xi'an College of Metallurgy and Architecture

TITLE: "Some Problems of Small and Medium-sized General Hospital Design"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 26-31

ABSTRACT: In the process of compiling the book SHAANXI ZONGHE YIYUAN JIANZHU [SHAANXI GENERAL HOSPITAL ARCHITECTURE], the author carried out a survey of more than 20 general hospitals in the province of different scales constructed in the past few years. In order that the research may be of help for future designing work, problems learned during the survey are discussed in the paper. These problems concern mainly designs of the department of radiology and the department of surgery in small and medium-sized hospitals with 300 beds or less.

AUTHOR: XU Qiangsheng [1776 1730 3932]

ORG: None

TITLE: "Emancipating the Mind and Flourishing Architectural Creation"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 32-33

ABSTRACT: Early in Dec 79, 2 symposiums on design ideas and problems were sponsored by Shanghai Architectural Society. Discussions centered upon the subject of "emancipating the mind and flourishing architectural creation.' The participants of the symposiums appeared to be in agreement on the following: (1) In order to emancipate the mind, it is necessary to distinguish right from wrong. Several cases of persecution of architects by the gang of four are cited to demonstrate the confusion between right and wrong in the past. (2) In order to let hundred flowers bloo , it is necessary to have democracy. The problem of right and wrong in arts and sciences should be resolved through free discussions among artists and scientists. (3) In order to raise the level of designing, it is necessary to have correct ideological guidance. All agreed to implement the policy of 'practical, economical, and paying attention to aesthetics when conditions permit' but objected to all forms of unfounded criticisms suffered by architects in the past.

AUTHOR: CHEN Shimin [7115 0013 3046]

ORG: None

TITLE: "National Form and Architectural Style"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 34-39, 62

TEXT OF ENGLISH ABSTRACT: In the process of creating new architectural style, what attitude should be taken towards the Chinese inherent architectural tradition is a knotty problem often encountered by the architect. 'National form' has long been habitually used to replace the ancient architectural tradition and its unique style, and sometimes 'national form' has practically become the major criterion in determining the finalized design project of some large-sized public buildings. This article deals with some problems concerning 'national form' such as (1) can it represent the Chinese architectural tradition? (2) Does it meet the needs of modern architecture? (3) How to develop national style? and so on.

[continuation of JIANZHU XUEBAO No 2, 80 pp 34-39, 62]

The writer holds that it is unsuitable and unscientific to regard the so-called 'national form with its characteristics of large glazed-tile roofs and axial symmetry as the representative of the Chinese architectural system. The characteristics of the Chinese classical architecture are many-sided. Apart from its elegant form and unique style there are many characteristics which belong to the essence of the Chinese architectural heritage, such as diversified methods of organising building groups, the wide application of standardization to individual buildings, the shifting and flowing effect of spaces, the combination of architecture with natural setting, as well as the unique finesse of landscaping and gardening, varied techniques of decoration and so on. Therefore, in searching for the right way of inheriting tradition and creating new national style, it is necessary to make approach to the problem in all its aspects.

The writer has concretely analyzed and evaluated some large-sized public buildings set up after liberation, including the Chinese Arts Museum and the National Cultural Palace in Beijing, the Friendship Theater in Guangzhou,and and the Hangzhou Theater by the West Lake. He has also mentioned those small-sized public buildings, such as exhibition halls, hotels, restaurants, tea houses, etc. which have successfully employed vernacular idioms both in designing general layout and spatial composition and in using locally available building materials and traditional construction technique.

AUTHOR: None

ORG: None

TITLE: "Selected Design Projects for Urban Housing (Continued)"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 40-42, 9

ABSTRACT: Drawings and specifications of design projects submitted by architects in provinces of Hebei, Henan, Anhui, and Liaoning that won prizes in the national competition are selected and reproduced in the paper.

AUTHOR: HE Yechen [0149 2814 5256]

ORG: None

TITLE: "Evolution of Marketplace and Residential Quarter in the City Planning System of Tang and Song Dynasties"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 43-49

TEXT OF ENGLISH ABSTRACT: In the literature of Chinese ancient city planning, the term Shi means commercial district or marketplace, and Fang residential quarter. This article deals with the evolution of Shi and Fang in the city planning system of Tang and Song Dynasties. The writer has cited some famous ancient cities such as the Tang capital Changan (today's Xi'an) and the Song Capital Kaifeng (then known as Dongjing) and Lin'an (today's Hangzhou) etc. to elucidate his views. He points out that Changan is a typical example which embodied the principles of ancient Chinese city planning system. In Changan, a north-south thoroughfare divided the southern part of the city into two parts, each with a busy market, Shi. All the workshops and business firms were totally concentrated within them; the East Market had thousands of shops belonging to 220 trades. Fang, the residential quarter, was generally surrounded by streets running north-south and east-west and was enclosed with walls.

[continuation of JIANZHU XUEBAO No 2, 80 pp 43-49]

Since the middle period of Tang Dynasty (618-907) commerce had grown with agriculture and handicrafts. More trading necessitated the expansion of market. In Changan and other big cities this period saw the appearance of shops established in residential quarters. During the later period of the Northern Song Dynasty (960-1127) there was no line of distinction between market and residential quarter-an indication of the thorough destruction of ancient city planning system. And the capital of Southern Song Dynasty (1127-1279) Lin'an was in fact a completely new-type city.
In the writer's view, the evolution of market and residential quarter in the Tang and Song Dynasties is a key problem in studying the history of Chinese city planning system of from 7th to 13th centuries.

AUTHOR: ZHOU Buyi [0719 0592 7328]

ORG: Department of Civil Engineering, Qinghua University

TITLE: "Comments on Some Famous Buildings of the 70's in Europe and America (Continued)"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 pp 50-62

ABSTRACT: This, the concluding installment of the paper contains the following chapters: (6) The World Trade Center and the Sears Building -- the Tallest Buildings of the World in the 70's; (7) Designing of the Modern Apartment and Office Complex, La Défense in Paris; (8) The National Library of Berlin, West Germany, designed by Hans Scharoun; (9) Helsinki Conference Building of Finland, designed by Alvar Aalto; (10) New Architectural Ideas and Products: the technological school, the brightness school, and the post-modernism school of architects and their representative works are analysed and discussed.

AUTHOR: None

ORG: Designing Division, Huaibei Bureau of Mines

TITLE: "Architectural Record: The Dining Hall and Auditorium of Huaibei Bureau of Mines"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, Mar 80 p 63

ABSTRACT: In the past, in designs of the square or mall of coal mining industries, the dining hall and the auditorium are often separate structures, which occupy more land, consume more capital investment, and require more underground pillars to protect the foundation. For overcoming these shortcomings, an attempt was made to design a combination structure for the dining hall and the auditorium of the Huaibei Bureau of Mines. Two dining rooms, with a capacity of serving one thousand persons are arranged on the first floor of the building, with adjoining kitchen complex outside of the main building so that the smoke and odor will not spread to the auditorium which is located on the second floor above the dining rooms. The autidorium has 1,300 seats, equipped for stage plays as well as motion pictures. The total construction area is 2,600 m^2.

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CSO: 4009

AUTHOR: WEN Chunnyuan [2429 0278 3293]

ORG: Professor, Beijing College of Aviation

TITLE: "Aviation Technology and Electronics Technology"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 p 2

ABSTRACT: For a very long period of time, designing of aviation instruments had centered upon gas mechanics. Since the rapid development of control theory, electronics technology, and computer system, aviation technology entered a new stage of general designing of flight instruments centering upon control systems. The French Mirage-2000 and the American F-16 are, for instance, all new airplanes designed with application of certain control concepts with a resultant reduction of weight of 8-10 percent and close to 21 percent smaller engines. Moreover, pilotless aircrafts are receiving more and more attention in Europe and the United States. The article, "Battlefield of the 1990's" published in U.S. News and World Report on 4 Jul 77 is quoted to explain the importance of electronics in the development of aviation technology.

AUTHOR: ZHOU Zhicheng [0719 5267 6134]

ORG: Professor, Shanghai Jiaotong University

TITLE: "Electronic Equipment and Modernization of Industrial Production"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 2-3

ABSTRACT: The world has entered the era of electronics. The use of electronic equipment in industrial production include, generally speaking, the 3 aspects of controlling production, managing plants, and for scientific research, designing, and data analysis. The paper proceeds to exemplify in general terms various applications of electronic equipment in these 3 aspects.

AUTHOR: LIU Shenggang [0491 4141 4854]

ORG: Professor, Chengdu College of Telecommunications Engineering

TITLE: "Urgently Develop Research Work in High Energy Electronics"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONICS SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 3-4

ABSTRACT: Between microwaves and optical waves, there is a very wide frequency band, from millimeter wave, submillimeter wave to far infrared ray and infrared ray, which are all extremely important in national defense, scientific research, and the national economy, but there have not been enough studies to develop them. The key reason is a lack of signal source. The ordinary microwave tube using macro-electro mechanics as the foundation is very difficult to work with when the wavelength is less than several millimeters. The property of the tube will suddenly deteriorate. Many years of hard labor preceded the early 70's, when a breakthrough occurred. This is the so-called gyrotron, which is an electromagnetic wave band pass amplifier. Gyrotron will find applications in millimeter radar, controlled thermonuclear fusion, far infrared ray or even shorter wavelength. If it is applied to high energy electrons, free electron laser may be produced, to form a laser device capable of being tuned. In China, work in this field has just begun. A steady advancement of the subject is urged.

AUTHOR: XU Di [1776 2769]

ORG: Assistant Researcher, Institute of Communication Signals, Ministry of Railways Academy of Scientific Research

TITLE: "Modernization of Electronic Technology and Railway Communications"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 4-5

ABSTRACT: Electronic technology and the modernization of railway communications is very closely related. In the past 3 decades, digital communication, stored program controlled electronic exchange, multi-band radio communication, etc. even optical fiber transmission technology, have all begun to be applied in railway communications. Modernization of railway is for resolving such problems as safety, punctuality, speed, and economy. The resolution of these problems depends upon a complex automation system for managing railway transportation. At present, in China, railway communication depends primarily upon cable, assisted by radio. This paper relates briefly various electronic communication techniques that are necessary for a modernized railway system in China.

AUTHOR: CAO Zhidao [2580 1807 6670]

ORG: Assistant Professor, Harbin Industrial University

TITLE: "Brief Discussion of Techniques of Processing Radar Signals"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 5, 9

ABSTRACT: Radar was born to defend against attacks by airplanes. It has had by now a history of 30-40 years. It uses the electromagnetic echo wave of the target to determine its location and other parameters. With the increasingly improved capability of aircrafts, it has also become necessary to improve the capabilities of radar. In the first stage, new frequency bands and more perfect components were developed. In the second stage, research studies concern themselves with forms of radar signals and methods of processing them. At present, a revolution in signal processing has occurred to cause the data processing equipment to become an important constituent part of the radar and the radar of the first stage to be called the classic radar. Such equipment includes the Doppler filter and the electronic computer digital signal processer. The difference between the modern radar and the so-called classic radar is briefly explained.

AUTHOR: SUI Jingyi [7131 4842 0034]

ORG: None

TITLE: "General Condition of Development of Broadcasting and Television Equipment"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 6-7

ABSTRACT: In the recent decades, there has been a very rapid development in audio broadcasting. In Europe alone, there are more than 400 stations of above 500kw power. After the liberation, 120 kw shortwave and 500 kw intermediate wave broadcasting equipment was made in China in the 50's, and toward the end of the 60's and the beginning of the 70's, 600kw shortwave and 1500kw intermediate wave equipment was also produced in China. Compared with foreign countries, the greatest distance of China is in the utilization of F.M. band. This paper reviews briefly the conditions of audio broadcasting and reception and vidio broadcasting and reception in foreign countries and in China for the primary purpose of assessing the areas of future efforts.

AUTHOR: ZHANG Benjing [1728 2609 2417]
ZOU Wenzhang [6760 2429 4545]

ORG: Both of Bureau of Science and Technology, Fourth Ministry of Machinery

TITLE: "Urgently Extend Digital Control Technology and Accelerate the Reconstruction of Electronic Industry"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 8-9

ABSTRACT: Digital control technology is the important means for realizing industrial automation. It is a combined utilization of computer, semiconductor, automatic control, and automatic testing and measurement. Since the adoption of microprocessers, a new stage of digital control has arrived. At present, in foreign countries, IMS, CAD, and CAM systems have begun to be combined to achieve total automation of production, and these systems also have the functions of production planning and production management. In the process of improving labor productivity, the quality of the products, and reliability, the workers have also be liberated from heavy work by these innovations. The paper suggests that China should begin with the special condition of production of the electronic industry to proceed with the installation of digital control technology and application of automatic testing and measurement for the purpose of realizing modernization of the electronic industry within this century.

AUTHOR: LIN Xiangping [2651 6272 1627]

ORG: None

TITLE: "Answer Type Interference Machine and Its Advancement"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11 Nov 79 pp 10-14

ABSTRACT: The anser type interference machine is a late comer among radar jamming devices. Since its appearance in the late 1950's, its development has been extremely rapid and has become an important defensive weapon for various types of aircrafts and submarines. Before its appearance, radar jamming devices all require to be led by detection receptor in either frequency or direction in order to use continuous wave noise interference, which is effective for many types of radar, but they are not deceptive. In other words the target radar is immediately aware of the jamming activity and can proceed to track the source of interference, which may become the target of firing power. The answer type interference device has the travelling-wave tube as the key component and can produce deceptive interference. This paper describes its basic composition, types, and characteristics. Manners of its operation and major technical parameters are also briefly explained.

AUTHOR: WANG Peida [3769 1014 1129]

ORG: None

TITLE: "Experimental Injection of Oxygen Ions into Silicon"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 15-19, 46

ABSTRACT: This paper relates an experiment on injecting large dose of oxygen ions into silicon to obtain a high density oxygen ion injection layer. The experiment demonstrates that the injection region is a high resistance layer. The possibility of using the high resistance layer for a separator in integrated circuit is investigated. The paper introduces the depth distribution of oxygen ions in the high density oxygen injection layer, the crystalline structure, and some physical chemical characteristics according to experimental observations. It is also discovered in the experiment that the injection of high density oxygen into silicon affects the depth distribution of previously injected boron. It appears that the injection of oxygen ions has an absorption action on boron ions.

AUTHOR: ZHANG Tielin [1728 6993 2651]

ORG: None

TITLE: "Discussion of Several Problems in High Gain Microwave Transistor Power Amplifier"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 20-22

ABSTRACT: This paper introduces the high gain microwave power amplifier made with the transistor 4G42, which is a Chinese product. In 1GHz, this amplifier can produce 16dB gain. Flow limit protection, test box design, and measurement of dynamic impedance, and other concrete problems encountered in the process of making the amplifer are also introduced.

AUTHOR: ZHANG Shifeng [1728 1395 7364]

ORG: Nanjing Institute of Electronic Technology

TITLE: "Comments Concerning Several Problems in Improving the Productivity of Scientific Research"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 23-25

ABSTRACT: The Nanjing Institute of Electronic Technology has more than one thousand engineering technicians and several thousand workers. It receives close to 10 million yuan of funds from the state every year. The author maintains that he and his colleagues should, therefore, contribute a great deal to national defense and national construction. The institution has not accomplished this objective for many years. Aside from destruction and interference it received from LIN Biao and the gang of four, the lack of a scientifically organized management system and the corresponding leadership technique were the author maintains, also an important reason. In the paper, some opinions concerning the managmment system of research institutes, concerning improving the labor productivity of research persons, and concerning a reorganization of the management system of research institutions are presented.

AUTHOR: CHEN Gongfu [7115 0501 1381]

ORG: Harbin Industrial University

TITLE: "Cyclic Code Sequential Circuit"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 26-30

ABSTRACT: In multi-pass communication and multi-pass remote survey systems, a sequential circuit of satisfactory properties is desired to produce successive pulses for the realization of sequential conversion of remote test signals of the various passes or audio frequency signals according to the time. In the past, successive delays or a serial counter were used to obtain the objective. With the former, it was difficult to unify the various parameters of the delayed items and the device was rather voluminous. With the later, the output pulses were not of good quality. This paper introduces a new method of sequential division of passes. The circuit is explained at length.

AUTHOR: ZHANG Guihai [1728 6311 3189]

ORG: Liaoning Potentiometric Instrument Plant

TITLE: "Improving the Properties of Resistors and Potentiometric Instruments With Carbon Type Organic Solid Core"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 30, 35

ABSTRACT: Carbon type organic solid core potentiometic instruments have high rate of differentiation, good heat resistance, low cost, and other advantages, and are therefore promising as general purpose resistors and potentiometers. At present, several problems of temperature, dampness, aging, etc. exist with these potentiometric instruments and resistors. The property of the carbon power is determined by the temperature during its production, the temperature of refining, the structure of the crystals, the characteristics and quantity of the oxides on the surface, etc. This paper discusses various important measures during the process of producing the resistors and potentiometers, aside from careful selection of the materials, if satisfactory products are to be obtained.

AUTHOR: DUAN Chenghua [3008 2973 5478]

ORG: Hunan University

TITLE: "Random Control of Multi-route Multi-information Multi-pass Broadcasting"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 31-32

ABSTRACT: Using an actual design, this paper explains the way to utilize random phenomena to realize the control of a series of random motions in multi-route, multi-information, and multi-pass broadcasting. It further explains that utilizing random theory, the break point of the design may be quickly discovered to obtain the optimal design of the system so that the system may be simple, adaptable, and reliable. The probability analysis of the random motions of the system to be controlled, hypotheses of a random circuit, the establishment of a control system, and the analysis of system reliability are discussed.

AUTHOR: None

ORG: Information Office, Beijing Radio First Plant

TITLE: "Electronic Computer Controlled High Threshold Value Logic Component Intermediate Test System"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 33-35

ABSTRACT: The Beijing Semiconductor Device Third Plant and Beijing Radio First Plant have researched and made a high threshold value logic component intermediate test system using digital electronic computer DJS-19 for automatic control and for processing the test parameter data obtained. At the conclusion of the test, statistical figures are printed out. This system successfully reduces the labor intensity of the workers while supplies the parameter distribution of each batch of components timely. The composition of the test system, its work principle, its joint logic, its test procedure, and its technical properties are explained.

AUTHOR: ZHENG Wenhao [6774 2429 3493]

ORG: None

TITLE: "A Review of Large Scale Integrated Circuit in Europe"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 36-39

ABSTRACT: In early May, the Chinese electronic industry delegation headed by the Deputy Minister of the Fourth Ministry of Machinery flew to Europe to visit West Germany, Holland, Switzerland, Italy, and Rumania to observe communications, radar, computers, electric vacuum, semiconductors, no-source components, liquid crystal display, electronic watches, artificial satellite ground stations, and management systems of city and air transportation, etc. The author admits that before this trip, the level of large scale integrated circuit in Europe has been underestimated in China. This paper reports the conditions observed in these European countries and describes several characteristics of development of European large scale integrated circuits. Based upon the observed data, the author offers several suggestions concerning the development of China's large scale integrated circuits.

AUTHOR: WANG Dechen [3769 1795 5256]

ORG: None

TITLE: "How is the Computation Speed of a Computer Estimated"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 40-42

ABSTRACT: For the early stage computers, the storage cycle of the main storage unit and the time needed to complete one addition are used as the standard to figure the speed of the computer. With today's computers, the computation capabilities are extremely complicated, and this standard is no longer applicable. Toward the end of the 50's, some foreign scientists made a statistical calculation of machine instructions of a large number of programs of scientific subject matters to find the statistical figure of the ratio of various types of instructions. The time a machine requires to execute each type of instruction is taken and is multiplied by the ratio of occurrence of that type of instruction to arrive at a sum for the purpose of finding the mean execution time of a mixed instruction. The number of mean instructions a computer can execute per second is called that computer's speed of computation. This paper gives the detail of this standard of estimating the computation speed of a computer.

AUTHOR: ZHANG Youia [1728 1429 5248]

ORG: Beijing Institute of Computer Technology

TITLE: "lectures on the Operating System of Electronic Computers (III)"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 43-46

ABSTRACT: This third lecture of the series is devoted to the theory of the operating system. The operating procedure of a computer, from the card input or the terminal to the magnetic disk or directly to the internal storage before reaching the printer is explained. There is also a section explaining the external storage facilities, and the procedure each customer uses to input instructions, i.e. the job control language (JCL). The paper does not specify whether or not the series is completed or to be continued.

AUTHOR: None

ORG: None

TITLE: "(1) The Second Annual Conference of the China Electronics Society Was Held in Lyuda; (2) A Roster of Members of the Second Standing Council of the China Electronics Society"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 pp 47, 25

ABSTRACT: The second annual conference of the China Electronics Society was held in Lyuda City of Liaoning Province 15-22 Jul 79. More than 340 delegates representing Electronics Societies of various provinces, cities, and autonomous regions attended. This was the first large gathering of scientists, professors, specialists, and leaders of the field of electronics since the Society was established in 1962. Many are gray-haired older generation scientists, some have matured to middle age, and a few are young new comers. The conference emphasized listening and examining work reports, revising the society's charter, discussing membership of the standing committee, and exchanging scientific experiences. The conference resolved to reserve a given number of vacancies on the Standing Committee for Taiwan Province. The second part of the paper consists of a list of names elected to the Second Standing Committe, headed by the chairman LIU Yin [0491 1377] and concluded by the honorary committee member, LI Qiang [2621 1730].

AUTHOR: None

ORG: None

TITLE: "Recipients of Prizes at the National Second Black and White Television Receiver Competition, the National Graphic Display Instrument Competition, and the National Television and Radio Receiver Parts Competition"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 p 48

ABSTRACT: Twenty-five prizes were awarded by the National Second Black and White Television Receiver Competition in 5 categories of the 9, 12, 14, 16, and 19 inch sets. The First prize for the 19 inch set was won by Shanghai Radio 1[illegible]th Plant, and no second prize was awarded in that category. Three prizes were awarded by the National Graphic Display Instrument Competition, with the Shanghai Radio 21st Plant winning the first prize. Thirty prizes were awarded by the National Television, Radio Receiver Parts Competition. The first prize for a high frequency tuner was won by Dantong Television Parts Plant. The remaining categories are the 13 inch output transformer, the television triode, the synthetic film potentiometer, the CBM202-B_1B_2 thin film variable capacitor, and the rectangular plug board.

AUTHOR: None

ORG: None

TITLE: "Front, Inside Front, Back, and Inside Back Covers"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 79 front, inside front, back, inside back covers

ABSTRACT: The front cover of this issue is a photo of Professor DU Wenhu [2659 2429 5706] and an associate testing the non-chromatic dispersion atomic fluorescent photometer, which is the product of successful joint research by the Northwest University and the Xi'an Radio 8th Plant. The inside front cover contains photos depicting a traffic light control instrument, its time control device, and an automatic atmospheric sample collector (the above are products of Bangbu Radio 2nd Plant) the ceramic encased resistors (a product of Bangbu Radio 6th Plant)the YSD-4 rectangular wave exciter for pharmacological and physiological uses (a product of joint research by Bangbu Medical College and Bangbu Radio 2nd Plant) various semiconductor transformers, pickups, etc. (products of Bangbu Semiconductor Instrument Plant) and several speakers (products of Bangbu Radio 4th Plant.) The back cover contains photos depicting workers of the Fouyang Radio Plant of Anhui Province and its newest product, the XO-10 Precision Signal Generator. Specifications of the signal generator are des-

[continuation of DIANZI KEXUE JISHU No 11, 79 front, inside front, back, inside back covers]

cribed. The inside back cover contains a list and drawings of 10 products of the Xiamen City Medical and Electronic Instrument Plant. These are among 17 products manufactured by the plant. All 17 products are briefly described, although only 10 of these are illustrated.

AUTHOR: HOU Xianglin [0189 4382 7792]

ORG: Vice Minister of Ministry of Petroleum Industry, President of China Petroleum Society

TITLE: "Application of Electronics in the Development of Petroleum Industries"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 2-3

ABSTRACT: The major responsibilites of the petroleum industries are to discover and mine crude oil and natural gas and to process and refine various petroleum products. The modernization of petroleum industries is closely related to the exploration, refining, and pipe-line transportation of oil, as well as other sciences and technologies, including education, management, electronics, scientific research, etc. In this paper, the author emphasizes the importance of electronic technology in petroleum exploration, construction and management of gas and oil pipe-lines, oil refineries, and the aspects of research, education, designing, and data gathering of the petroleum industries.

AUTHOR: ZHANG Zhizhong [1728 4160 0022]

ORG: Chief Engineer, Nanjing Institute of Electronics

TITLE: "Brief Discussion on Radar"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 3-4

ABSTRACT: In English, Radar is the abbreviation of 'Radio Detection And Ranging. Its theory is the use of sharply directional electromagnetic pulse wave to project onto a target or a target space for the purpose of receiving echo wave from the target in order to obtaining various parameters and characteristics of the target, including its distance, direction, height, speed, shape, and direction of rotation, etc. The types of parameters to be obtained by a radar device depend upon the objective of the radar design. The major objectives of simple radar device include the distance and direction of the target only. There are also three-coordinate radar device and modern radar devices that are combined with electronic computers. The development of moder radar depends primarily upon new components and devices. System engineering theory, nonlinear system engineering theory, network analysis, digital wave filter theory, control theory, etc. promote the development of new devices, which, in turn further perfect these and other theories that are all closely related to the advancement of radar technology.

AUTHOR: LIN Shie [2651 1102 6166]

ORG: Professor, Beijing College of Aviation

TITLE: "On Gyro and Electronics"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 4-5

ABSTRACT: There are 2 types of gyroscopes. One type is called regular gyroscopes, which are relatively inexpensive to make but have rather extensive applications. The other type is called precision gyroscopes, which are high cost but their applications are growing more and more extensive. Both types of gyroscopes are closely related to the development of electronics. This paper explains briefly the relationship between gyroscopes and inertial guidance system and gyroscopes and the application of electronic devices in gyroscope technology.

AUTHOR: CAI Changnian [5591 7022 1628]

ORG: Professor, Beijing College of Post and Telecommunications

TITLE: "Information Theory and Information Science"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 5-6

ABSTRACT: Information theory is a theory for studying problems relating to information. The term, information, does not yet have a commonly agreed definition, but it is sufficient to understand it as a concept of ordinary living, such as the term in "Have you any information?" and "There is some information." But, information is not the same as news. News can take the form of sequential symbols, digital data, tables and graphs, music, drawings, motion pictures, etc. and there should be a unified method and unit to measure the amount of information in each of these forms of news. The job of information theory is to study the optimal method of obtaining information and converting, transporting, storing, sorting, displaying, recognizing information. The so-called optimum refers to the rate of efficiency and reliability, and of course, the problems are not limited to technologies. There is not yet a consensus concerning the scope of information science, but at least it includes information theory, control theory, system engineering, computer inquiry system, bionics, artificial intelligence, etc. This paper introduces briefly the 2 terms of information theory and information science.

AUTHOR: (1) ZHANG Xi [1728 3556]
(2) None

ORG: (1) Professor, Shanghai Jiatong University; (2) None

TITLE: "(1) Development Tendency of Communications Technology; (2) Shelf of New Books"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 6-7

ABSTRACT: (1) For a relatively long time, FDM [frequency-division multiplexing] system has been rather popular for long distance communication. At present, in international satellite communication the FDMA system is mostly used. Currently in China, domestic communication depends largely upon coaxial cable and microwave link system, while in international communication, synchronous satellites and ocean-floor cables are mainly used. In the most recent years, there has been a rapid increase of demands for digital communication. Aside from designing some equipment to cause the existing simulation systems to be more effectively transmitting digital data, PCM, TDM, TDMA systems have also been introduced. It may be said with certainty that in the future there will be more and more development in the direction of digital communication, while the most effective and most promising among modern communication systems are satellite communication and optical fiber communication. Whilecommunications technology extends from microwave to optical wave, electronics is leading toward photo-electronics and photonics, integrated circuits will expand to integrated optical circuits.

[continuation of DIANZI KEXUE JISHU No 12, 1979 pp 6-7]

The author discusses all these systems very briefly without describing or defining, and predicts that in the coming one to two decades, there will be sudden and obvious reforms in the realm of communications.
(2) In this regular column of the journal, 3 books are mentioned. (a)"Antiradar" edited by WANG Dianyong [3769 3013 0516] to be published in Sep 79. (b) "Design Handbook of Electronic Scanning Radar System" by P.J. Kahrilas of the United States and translated by Jinjiang Editing and Translating Group, to be published in Jul 79. (c) "Microwave Ferrite Linear Device Theory" edited by XIANG Hensheng [0686 0088 3932] to be published Jul 79. Each of the above 3 books is briefly described.

AUTHOR: WANG Fuqing [3769 4395 1987]

ORG: None

TITLE: "Method of Computing Noise Temperature of Large Cassegrainian Antennas"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 8-13, 35

ABSTRACT: Due to the development of satellite communication, space technology, and radio-astronomy technology, many departments have rapid needs for large Cassegrainian antennas and the demands for their properties are becoming higher as well. For the purpose of improving the information-noise ratio and the precision of observation, the antenna must be highly efficient and have low noise property. As the antenna property is the gain and noise temperature function, which is also called the quality factor, the problem of precision computation of noise temperature of an antenna at any angle of elevation has become the key in large antenna designing. In Cassegrainian antennas, the major factor affecting the noise temperature is power leak (or power scatering.) This paper introduces the method of using antenna efficiency for computing Cassegrainian antenna noise temperature. Compared with other methods, this method can easily produce the noise temperature at any angle of elevation. Repeated experiments indicate that the computation error is less than 5 percent, compared with the test value. The relationship between antenna noise temperature and efficiency, the computation of antenna efficiency, and the computation of mean brightness temperature are explained at length.

AUTHOR: ZONG Xiangfu [1350 4382 4395]
FENG Guanhua [7458 0385 5478]

ORG: None

TITLE: "Absorption Elimination of Point Defects in No-displacement Silion Chips"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 14-16

ABSTRACT: When no-displacement silicon chip is used to make P-N-P transistors with the antimony dispersion technique, a high density sediment mass appears on the surface of the silicon chip to cause the P-N junction to be soft and perforating. If the phosphorus dispersion method is adopted, due to the fact that it is difficult to control the phosphorus density, β of the transistor fluctuates a great deal. This paper explains a method of utilizing the interactions of defect-defect, defect-foreign matter, and foreign matter - foreign matter, or utilizing stress action to cause point defects or foreign matter atoms to collect in a specified region. With this method, called absorption elimination, the antimony dispersion technique is made suitable for production. The frequency characteristic and the noise characteristic of the transistor product have been greatly improved as well. Other new products have also been made utilizing this method.

AUTHOR: SHEN Laipei [3088 0171 3099]

ORG: None

TITLE: "Relaxation Oscillators of Very Extensive Applications"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 17-19, 16

ABSTRACT: The relaxation oscillators introduced in this paper may be used to produce asymmetrical pulses and sawtooth waves. When one of these is used as a frequency divider, narrow pulses may be obtained at once so that it would not be necessary to form narrow pulses after frequency division. In forming a capacitor, a series resistor may be introduced on the side to obtain sawtooth waveform pulses simply and conveniently. Due to the fact that there are the 2 types of NPN and PNP transistors, various mutually coupled circuits may be obtained easily. The relaxation oscillator circuit and its mathematical analysis are explained.

AUTHOR: HUANG Changteng [7806 0006 7506]

ORG: Shanghai Radio Thirteenth Plant

TITLE: "Drilling Machine Group Control Program System"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 20-23

ABSTRACT: Hole drilling is the most labor and time consuming process in printed circuit board production. For the purpose of improving the speed and quality of drilling and reducing the intensity of labor, the Shanghai Radio Twentieth Radio Plant established a drilling machine group control system, using digital control technology. The system can be linked to a maximum of 24 drilling machines and 2 program compilers used to arrange the data concerning the positions of the drill holes. The hardware of the control system includes a DJS-131 computer, a G-2 photoelectric paper tape input machine, a CK-160 fast paper tape hole puncher, stepper motor control passes, etc. The bulk of the paper explains the real-time operation system (RTOS).

AUTHOR: ZHANG Naiguo [1728 0035 0948]

ORG: Qinghua University

TITLE: "Designing of Ferrite Magnetic Core Power Transformer"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 24-26

ABSTRACT: When ferrite magnetic core is used in communication broadcasting or control circuit small power transformers, a great deal of silicon steel plates may be saved, while the production efficiency is higher and the production cost is lower. At present, there is an urgent need of using it in circuits of relatively larger power, however. This paper, therefore, introduces the use of this type of magnetic core in transformers of several hundred volts of power. The characteristics of the soft magnetic ferrite and the basic considerations of designing this type of power transformers are discussed. Four sample designs are given.

AUTHOR: ZHANG Shaoshu [1728 4801 2579]

ORG: The 1412 Research Institute, Fourth Ministry of Machines

TITLE: "Microwave Heat Therapy for Cancer Treatment"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 27-28, 44

ABSTRACT: It has been discovered here and abroad that cancer cells are a type of oxygen deficient cells and are therefore much more heat sensitive than normal cells. Generally, when the temperature rises to above 41°C, cancer cells will die. The blood flow of cancerous tissues is only 1-15 percent of normal tissues; therefore their ability of heat dispersion is weaker also. Heat therapy is thus proposed for killing cancer while not injuring normal cells for the purpose of controlling the spread of cancer and localized cure of the disease. Microwave has many advantages as the source of heat for this purpose. In cooperation with Beijing Ditan Hospital of Chinese Academy of Medical Sciences, the 1412 Research Institute applied microwave heat therapy in experiments and in clinical practice since early 1978. The case histories of 2 patients are reported. Problems of microwave heat therapy are discussed.

AUTHOR: He Benyan [0149 2609 3508]

ORG: None

TITLE: "Research on Making Powder MetallurgyConstant Elastic Alloy Resonance Components"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 29, 44

ABSTRACT: At present, the method of producing constant elastic alloy is still primarily vacuum smelting anywhere in the world, and the powder metallurgy and complexing techniques are still in the research stage. The vacuum smelting technique has several shortcomings, however. This paper reports an experiment on the powder metallurgy technique. The composition of the alloy is Ni 42.14 percent, Cr 5.26 percent, Ti 3.4 percent, Fe the remaining; or Ni 37 percent, Cr 7.5 percent, Ti 2 percent, and remaining iron. The first composition is used to make mechanical wave filter vibrator; the second composition is used to make tuning fork resonator. A section of the paper introducing mainly a comparison of the property of the power metallurgy tuning fork and the tuning fork made of the 3J58 material.

AUTHOR: JIN Lan [6855 5695]

ORG: None

TITLE: "Report of the Sixth International Computer Structure Discussion Meeting"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 30-31

ABSTRACT: The Sixth International Computer Structure Discussion Meeting was held in Philadelphia of the United States 23-25 Apr 79. For the first time, a Chinese delegation of 5 members was invited to attend. Among the 299 participants, 172 came from industries to indicate that foreign computer companies have profound interest in new system structures. Of the 56 papers received by the meeting, 18 came from universities to indicate the importance and the degree of activity of universities in research work. Contents of these papers are briefly introduced.

AUTHOR: WANG Yuxiang [illegible]

ORG: None

TITLE: "Distinguishing the Enemy From Us"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 32-35

ABSTRACT: To distinguish the enemy from us is always an extremely important problem for military specialists and all possible [illegible] are adopted to accomplish this. Uniforms, decorations, banners, passwords, etc. are all for that purpose. In recent times, the development of long distance and fast action weapons have brought some difficulties. This paper explains 8 different types of recognition problems: from ground to ground, from ground to air, from coast to sea, from sea to sea, from sea to air, from air to air, from air to ground, and from air to sea, depending upon the position of the enemy or us to be recognized. Although devices used in the 8 types vary, the normal operation of these devices depend upon a close and harmonious link of all; therefore, these devices are combined to form a gigantic, complex, and tight system. Aside from direct observation and special signals, there is also the question-answer device which is composed of the [illegible] parts of a question device, an answer device, and a judgment display device. The operating procedure of these devices and the air communication control radar are explained.

AUTHOR: None

ORG: None

TITLE: "Electronic Products"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 37-38

ABSTRACT: Three products are described in the paper: (1) [illegible]-1 Logic Pulse Tester: It is made by Wenzhou Radio Third Plant, composed of the 2 parts of logic pulse probing device and logic pulse generator, and may be used for measuring various circuits using bipolar integrated circuit components. (2) TC-11 Magnetic Tape Device for Computer Use: It is an external storage facility of the data processing system, made by the Instrument Plant of Bureau of Material Exploration, Ministry of Petroleum. (3) A New Type of Complex Medium Capacitor: The Beijing Second Radio Instrument and Material Plant recently made a capacitor with series complex medium of polystyrene and polypropyrene films of different widths. The properties of the polystyrene capacitor are basically preserved, while the volume is smaller and the resistance to welding heat is much better.

AUTHOR: None

ORG: None

TITLE: "Electronic Products Continued"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 39-40, front cover

ABSTRACT: Four products are described: (1) YK-1 Radio Remote Control Equipment: It is the product of Jiangsu Liuhe County Radio Plant, mainly for vehicle operation, such as large derricks and earth movers and especially suitable for work under unhealthy environment of poisonous gas, dust, high temperature, acidity or alkalinity. It majour technical properties are described. (2) Tube-shpaed Micro-modulation Ceramic Medium Capacitor: It is the product of Chengdu Hongming Radio Material Plant and Yibin Hongxing Radio Instrument Plant. Major technical indices are given. (3) A New Printed Circuit Baseboard--THXB-68 self-extinguishing epoxy glass cloth tin-plated board. Its major properties are compared with those of the English-made CPG83 board in a table. (4) The front cover of the issue is a photo depicting China's first DGC-2 digital buried electrical cable testing meter, made by Northwest College of Telecommunication Engineering. It may be used to test high resistance and sealing troubles of underground electrical cables.

AUTHOR: ZHANG Youla [1728 1429 5248]

ORG: Beijing Institute of Computer Technology

TITLE: "Lectures on the Operating System of Electronic Computers (IV)"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 12, Dec 79 pp 41-42, 23

ABSTRACT: Comparing with knowledge of a large mansion, the author explains that the composition and work theory of the operating system discussed in the previous lecture are like descriptions of the rooms and equipment. In this lecture the designing and the construction procedure of the mansion are to be explained. This, the fourth lecture, is entitled the Technology of the Operating System. The lecture is divided into the 4 sections of the designing method, the reliability guarantee, protection [against environmental problems] and displacement allowance, and the evaluation of its properties.

6168
CSO: 4009

AUTHOR: LIANG Lingzhi [2733 1627 3112]

ORG: None

TITLE: "Solid-State Photographic Technique"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 pp 1-3

ABSTRACT: While electronic instruments are developing from electronic tubes to transistors, to integrated circuits, to large scale integrated circuits, i.e., in the direction of solid state, it has been the wishes of many people to throw away the vacuum tube, electron gun, etc. to realize solid state photography since the 1960's. It was not until 1970 when the Bell Laboratory of the United States invented the charge-coupled devices (CCD) that the wishes became possible. The solid state television camera appeared 2 years later. It took a few more years of efforts before the quality of the pictures of the solid-state image sensor reached the level of ordinary T.V. cameras. It is now completely capable of replacing the latter. The basic theory of the solid-state image sensor is explained.

AUTHOR: ZHOU Fangming [0719 2397 2494]
FAN Jinsheng [2868 6855 3932]
WANG Deyuan [3769 1795 3104]

ORG: None

TITLE: "Fast Double-yarn Detector"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 pp 3-6

ABSTRACT: An electronic instrument has been experimentally made by the authors to automatically detect double-yarn as the cotton yarn of about ϕ 0.20mm leaves the yarn divider. It is necessary that only one strand leaves the divider. If a double strand should accidentally appear, the detector can immediately recognize the double-yarn, sound an alarm, and shut off the machine. The rate of detection is 99.98 percent, and the rate of single-yarn error is 0.04 percent. The work principle, the structure, the light source, the electronic circuit, and the method of adjusting the detector are explained.

AUTHOR: TIAN Jiayi [3944 1367 3015]

ORG: None

TITLE: "Stereophonic Loudspeakers"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 pp 8-11, 27

ABSTRACT: The stereophonic speakers introduced in the paper have 20 w output power in both sound tracks. They may be used as loudspeakers, with a turntable, or radio. The circuit characteristics of the speakers and the authors' experience in making and testing them are related.

AUTHOR: PEI Jia [6316 0502]

ORG: None

TITLE: "Feiyao Brand 12D1A Black and White Television"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 pp 15-18, front cover, back cover, inside front cover

ABSTRACT: As the journal has published many papers concerning transistorized black and white television products, ordinary theories of the Feiyao 12D1A set are not repeated. The front cover of this issue contains a photo depicting the chasis and the internal structure of the set. The circuit diagram is reproduced on the inside front cover. A photo depicting the set in 3 sizes is reproduced on the back cover. The set won the first prize in the National Second Television Competition. The paper explains its high frequency head and the pass element. This paper is to be continued.

AUTHOR: LU Yi [7120 0308]

ORG: None

TITLE: "A New Method of Reducing Noise of Magnetic Tape"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 p 14

ABSTRACT: Most recently, in many brands of high grade magnetic tape recorders, the Dolby system has generally been adopted to reduce noise. All magnetic tapes have a hiss noise, which is especially annoying in the intermediate and high frequency bands. This paper explains the theory and practice of the Dolby system which successfully overcomes the hiss noise problem.

AUTHOR: LI Chuanzhong [2621 0278 6988]

ORG: Shanghai Radio Third Plant

TITLE: "Troubles and Repair of Chunlei JT4 Semiconductor Radio"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 pp 21-23

ABSTRACT: The Chunlei JT4 table model 12 transistor semiconductor radio receiver is beautifully designed and has good properties. This paper is intended as an owner's manual to explain some common problems and to assist him to repair his set by himself. The paper is divided into the 3 parts of low frequency, intermediate frequency, and high frequency circuits. Circuit diagrams are included in the explanation.

AUTHOR: SUN Minfang [1327 2404 2455]

ORG: None

TITLE: "Multiple-use Stable Voltage Power Source"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 1, Jan 80 pp 24-25

ABSTRACT: This paper introduces a stable voltage power source, with output voltages of 12, -12, 9, -6, 15, 18, 21, and 24 volts. At 12 volts, the current is 2 amps, at -12 volts 0.7 amps; for all remaining volts, it is 0.5 amps. It is suitable for 9 or 12 inch television sets, OTL, OCL radio and speakers, small turnables, recorders, semiconductor radios, and others. At present, the power source does not have protective device against short circuit or overload. The work theory of the power source is explained.

AUTHOR: XIAO Hongliu [5135 2646 2651]
WANG Liren [3769 0500 0086]

ORG: None

TITLE: "JSC-2 Multi-function Integrated Circuit Trigger Device"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 1-3

ABSTRACT: The JSC-2 integrated circuit chip is a type of multi-function trigger device. In the beginning, the purpose of this circuit is to integrate the transistor time-delay relay. Due to the fact that it has many superior properties, while it is also of small volume, low cost, reliable stability, and simple adjustment, it has now been extensively used in other automatic control equipment and contributed a great deal to technical reform. The structure and characteristics of the circuit, the basic parameters, etc. are explained.

AUTHOR: HE Jinsheng [0149 6855 3932]

ORG: None

TITLE: "Street Lighting Photoelectric Control Device"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 4-6

ABSTRACT: When ordinary transistors are used to make street lighting photoelectric control device, the predetermined result often cannot be obtained, due to extensive variation of light intensity to cause the circuit requirement to be too high. The author and colleague used the operation amplifier FC-54, which is a production of Shanghai Radio Seventh Plant to make an automatic control device for street lights. The circuit is highly sensitive and can effectively prevent the unstability when the circuit is in a state of transition. The device can keep track of variations of seasons and weather to adjust the early or late time for switching the lights on or off automatically. It may also be adjusted manually. It has the capability of resisting the interference from intense light of short duration caused by lightning or other factors. The work theory of the street lighting control device is discussed.

AUTHOR: YANG Tingnian [2799 1694 6365]

ORG: None

TITLE: "How to Design Logic Circuit"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 5-6

ABSTRACT: The paper, "Method of Eliminating 0" appearing in the No 4, 79 issue of this journal has attracted many readers to offer suggestions of further simplifying the circuit, and to discuss the subject from the method of analyzing the logic circuit and the method of designing. One of these suggestions is presented in this paper for the reference of other readers. The reader suggests that logic algebra is a very useful mathematic tool and it is possible to use it to resolve logic problems, such as the problem of eliminating 0. He then proceeds to explain the method and the steps in designing logic circuits, using methods of logic algebra.

AUTHOR: None

ORG: None

TITLE: "Super High Speed ECL Digital Integrated Circuits"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 p 7, front cover, back cover, inside back cover

ABSTRACT: The front cover contains the SE series super high speed ECL digital integrated circuits made by Shanghai Radio Seventh Plant with the assistance of Shanghai Institute of Metallurgy of Chinese Academy of Sciences and the 1424 Research Institute. This series of circuits, i.e. emission polar coupled logic integrated circuits, are fourteen in number, and one of them is a large scale integrated circuit, four are intermediate scale, and the remaining are small scale. The photo on the front cover is the super speed storage unit of the SE-64 large scale integrated circuit. The back cover is an advertisement of the Shanghai Radio Seventh Plant, proclaiming its use of computer assisted designing, strict inspection, and serious work procedure. The inside back cover of this issue lists a number of products of that plant, and one of these is the series of ECL super high speed digital integrated circuits.

AUTHOR: XIAO Hexiang [5135 0735 4382]

ORG: None

TITLE: "Box Type Magnetic Tape [The Cassette- Recording Tape]"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 8-10

ABSTRACT: The cassette recording tape was invented by the Philips Company of Holland in 1963 and since then it has been quickly and extensively adopted in many countries of the world. Its property and quality have been improved continuously and many new types have appeared. This paper introduces its basic characteristic, its structure, the correct method of using it, and the knowledge of its maintenance.

AUTHOR: LI Yingka [2621 2019 2818]

ORG: None

TITLE: "Total Symmetrical OCL Loudspeakers"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 11-13

ABSTRACT: The total symmetrical OCL loudspeakers are relatively more perfect power amplification circuit currently available. This means that all parts of the circuit are in a mutually complimentary symmetrical form to develop fully the advantage of having PNP and NPN transistors capable of working in unison. The output stage of this type of circuit is divided into the total complimentary and para-complimentary. At present, the para-complimentary type is more suitable for use by hobbyists. The circuit of the speaker is explained.

AUTHOR: FEI Jia [6316 0502]

ORG: None

TITLE: "Feiyao Brand 12D1A Black and White Television (Continued)"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 14-17

ABSTRACT: This portion of the paper discusses the visual quality of the television set, the accessory circuits, the scanning circuit, and audio portion, the major requirements of the transistors, and the major requirements of the capacitors. The paper is completed.

AUTHOR: GUO Ru [6751 3055-2606]

ORG: None

TITLE: "Combined Use of Transistors and Electron Tubes in Radio Receivers"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, Feb 80 pp 21-22

ABSTRACT: The advantages of transistors are low power consumption, small volume, vibration resistance and reliability, but electron tubes also have such advantages as large output power and wider dynamic scale, etc. In audio frequency amplification, especially in power amplifier circuits, electron tubes remain many people's favorite. A mixed use of transistors and electron tubes is discussed in the paper in the two sections of (1) Application of transistors in electron tube radio receivers; (2) Application of electron tubes in transistorized radio receivers.

AUTHOR: WANG Ke [[illegible]655 9134]

ORG: None

TITLE: "What Is Logic Algebra?"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 1-2, 5

ABSTRACT: In the process of technological reform and various engineering projects, logic circuits are more and more extensively applied. Starting with this issue, the journal plans to introduce continuously and gradually some basic knowledge concerning logic algebra and logic circuits. In this paper, the authors, in popular terms, the special algebra called logic algebra, or switch algebra. The word algebra does not mean the same as ordinary algebra, however. The basic operations of logic algebra and the true value of logic functions are explained.

AUTHOR: YAN Jinlong [0917 6855 7893]

ORG: Shanghai Radio Nineteenth Plant

TITLE: "Pulse Distributor of Stepping Motor"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 3, 5

ABSTRACT: This paper introduces a pulse distributor composed of a HTL integrated circuit of relatively strong interference resistance. It is capable of controlling the stepper motor to rotate forward or in reverse. The circuit is explained.

AUTHOR: WANG Deyuan [3769 1795 3104]

ORG: None

TITLE: "No Touch Point Long Time-delay Electronic Switch"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 4-5

ABSTRACT: Ordinary transistor long time delay circuits require many groups of touch point relays. When the relay touch points work, sparks are produced and the long time delay circuit easily receives interference to affect its operating reliability and precision of time delay. This paper introduces a new type of no touch point ng time delay electronic switch. It uses ordinary switch transistor to replace relays. The structure of the circuit is simple and the longest time delay may reach more than 6 hours. When the environmental temperature does not vary a great deal, it can meet ordinary precision requirement.

AUTHOR: FEI Yao [6316 7011]

ORG: None

TITLE: "Common Troubles and Repair of Feiyao 903 Television Receiver"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 8-10

ABSTRACT: In appearance, the common troubles of the Feiyao 903 television sets may be divided into 2 categories. The first type of trouble is the appearance of abnormal shapes on the screen when the set is not receiving television signals. The second type is when brightness is normal and signals are being received, but either the image or the sound are wrong in many ways. The method of locating the problemsand correcting them is discussed.

AUTHOR: CHEN Jiong [7115 3518]

ORG: Suzhou Television Receiver Plant

TITLE: "Protecting Picture Tube From Fires"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 12-13

ABSTRACT: Fires [ionization] of the high voltage electrode of the electron gun of the picture tube, or other electrodes form a common problem. This phenomenon interferes with the picture, destroys synchronization, and may even damage transistors. Various protection measures may be adopted, such as connecting a neon bulb between the negative electrode of the picture tube and the ground, or connecting a diode at the power source or suitably enlarging the negative feedback resistor R_{15}, etc. Details are explained.

AUTHOR: None

ORG: Department of Designing, Shanghai Recording Instrument Plant

TITLE: "The Shanghai Brand L-316 Cassette Recorder"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 14-15

ABSTRACT: The Shanghai Brand L-316 cassette recorder is a transistorized audio recording instrument for both A.C. and D.C. It may be operated with common cassettes of any country of the world, and is small and easily portable. Four batteries are needed to operate, but it has built-in voltage stagilizer to enable it to be operated on city current with a range of 150-240 volts. Its output power is about 2.5 w. It is equipped with a counter, a pulse button, and has the 2 modes of manual control or automatic. The circuit theory is briefly introduced. This paper is to be continued.

AUTHOR: XIAO Songlin [5135 2646 2651]

ORG: None

TITLE: "Integrated Circuit DY-ICII Model OCL Loudspeaker"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 16-18

ABSTRACT: This paper introduces a new OCL speaker with integrated circuit to be used primarily by hobbyists. When ± 15 volt power source is used, an output power of 6-10 w may be obtained. The integrated circuit makes installation very simple. The pre-amplifier, the tone control circuit, and the OCL main amplification stage are described.

AUTHOR: LI Jinchun [2621 6930 2504]

ORG: None

TITLE: "Major Characteristics of Some Transistors for Television Receivers in Foreign Countries"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 p 18, inside front cover

ABSTRACT: This paper explains a list given in the inside front cover of this issue of the journal.The list gives the major properties of transistors used in the TC1610 of Hungary, the DARIA4157A,B models 12 inch black and white sets of Czechoslovakia, and LIBRA203 model 19 inch mixed transistor and tube black and white television sets of Poland. The data were gathered and compiled by the author.

AUTHOR: WANG Chan[illegible] [3769 7022 1516]

ORG: Shanghai 1?1 Plant

TITLE: "[illegible] All Electronic Controlled Clock Radio"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 20-21

ABSTRACT: The [illegible] clock is one of the all electronic digital controlled radios made in China. A quartz transistor is used for the time device. As it is not affected by fluctuations of voltage of the power source and effects of temperature fluctuation are mild, year long use is guaranteed. Advanced C-MOS integrated circuit is used for the oscillator and the frequency division, and the P-MOS large scale integrated circuit is adopted for the clock and the clock control circuit MM5387AA. The display is composed of a luminescent diode LED. There are no gears, bearings, etc. mechanical devices; therefore, the phenomenon of abrasion does not appear. The useful life of the clock radio is estimated at more than 100,000 hours. The structure of the radio and the clock and control portions is explained in separate sections. This paper is to be continued.

AUTHOR: GUO Hu [6751 3055-2606]

ORG: None

TITLE: "Combined Use of Transistors and Electron Tubes in Radio Receivers (Continued)"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 pp 22-23, 21

ABSTRACT: The importance of the stabilizer is explained. If a stabilizer is not available, parallel connection of resistor and capacitor may be used as a substitute, but the stabilizing effect will be poorer. The paper continues to describe a typical electron tube power amplifier. With it, an output power of about [illegible] w may be obtained. The paper concludes with a section describing circuits of various stages of a mixed transistor and tube radio receiver to serve as an example.

AUTHOR: None

ORG: None

TITLE: "Front Cover, Back Cover, Inside Back Cover"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 3, Mar 80 front cover, back cover, inside back cover

ABSTRACT: The front cover of this issue of the journal contains a photo depicting the internal structure of a cassette recorder, but whether or not it is the cassette recorder described in a paper on p 14 of this issue is not mentioned. The back cover is an advertisement of Jushou Electronic Computer Plant, declaring its intention to cooperate wholeheartedly for the purpose of exploring the realm of computer applications. The inside back cover contains 2 advertisements. The upper portion is one by State-operated Hongwei Machine Plant, introducing its products, which include the [illegible]X-1 small analyser, a logic test board, a digital circuit trouble locating instrument, etc. The lower portion is one by Guangdong Province Fushan District Electroni Industry Company, which is the sales agent for Guangdong Zhongshan Radio Fifth Plant. The products advertised include the [illegible] Oscillograph, the GD-III Water and Soil Saline Content Testing Instrument, the [illegible] Automatic Temperature Testing Instrument, etc. Photos of some products are included in the advertisements. The contents of inside front cover are explained in a paper on p 18.

6168
CSO: 4008

SILICATES

AUTHOR: PAN Shiji [5400 0013 7456-6259]

ORG: Shanghai Institute of Silicates, Chinese Academy of Sciences

TITLE: "Defects Formation and Relations Between Defects and Properties of Fluorophlogopite Crystals"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 1-8

TEXT OF ENGLISH ABSTRACT: The morphology and formation of defects in fluorophlogopite crystals grown by moving crucible method with seed crystal are described from the standing point of crystal growth. Experimental observations are taken by polarized microscope, Twyman interferometer, and large area Lang's x-ray topography. It is revealed that there exist holes of silk-form, hexagonal holes, inclusions, growth striations, twinning boundaries, crystal basal face corrugations and other defects in fluorophlogopite crystals. These defects originate mainly from the defects of seed crystal and propagate in the crystaldue to change of temperature field and improper technical operations.

[continuation of GUISUANYAN XUEBAO Vol 8 No 1, 80 pp 1-8]

In order to grow perfect crystal, it is necessary to choose perfect seeds, maintain a stable temperature field and proceed the growth process properly. In the end, a preliminary discussion is attempted in regard with the relations between defects and properties of fluorophlogopite crystals, such as cleavage, mechanical, electronic and optical properties.
This paper was received for publication on 5 Jul 79.

AUTHOR: ZHANG Fukang [1728 4395 1660]
ZHANG Zhigang [1728 1807 0474]

ORG: Both of Shanghai Institute of Silicates, Chinese Academy of Sciences

TITLE: "Low Temperature Colored Glases of Successive Dynasties in Ancient China"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 9-19

TEXT OF ENGLISH ABSTRACT: Investigations have been made to disclose the chemical constituents of the fluxes and the colorants, the physical and chemical properties and also the microstructures as well as the technological aspects of the low temperature colored glases which occupied a very important place in the traditional Chinese pottery. The authors concluded that lead glase was invented independently by the ancient Chinese potters. These ancient glases all belong to the binary system, $PbO-SiO_2$, the chief coloring elements of which confine only to Fe, Cu, Co, and Mn. The so-called 'silver glases' of the Pre-Song Dynasties were found to be a translucent deposition with layer-structure and have nearly the same constituents as the copper green glase, except that they contain a small amount of phosphorus.
This paper was received for publication on 21 Jun 79.

AUTHOR: ZENG Shaoxian [2582 4801 0341]
JIANG Dongliang [3068 2639 0081]
MAO Zhiqiang [5403 1807 8825]

ORG: All of Shanghai Institute of Silicates, Chinese Academy of Sciences

TITLE: "A Study of Polarization of Calcia Stabilised Zirconia"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 20-29

TEXT OF ENGLISH ABSTRACT: Polarization of zirconia stabilised by adding 10 percent mol. calcia in field of d.c. has been investigated at 1300°C in air environment. Experiments were performed to study the effects of current density on the polarization and the development of polarization in relation to time at constant current density of $3A/cm^2$. The main phase change in polarized samples is the transformation of cubic zirconia into monoclinic, however, and transformation of phases can occur both at cathode and anode. When current density is increased to greater than $1A/cm^2$, a monoclinic layer is formed on the anode. The polarization also leads to changing electrical properties of the tested samples. The nature of polarization phenomena discussed in the light of structure of zirconia as related with electrochemical polarization. The authors inferred that the mass-transfer of oxygen could play an important role in controlling the phase transformation of zirconia electrodes.

AUTHOR: ZHAO Yuping [6392 1342 1627]
LIU Meiying [0491 5019 5391]
CHEN Min [7115 2404]

ORG: All of Cement Research Division, Academy of Building Materials

TITLE: "Effect of M F Water-reducing Agent on the Hydration of Portland Cement"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 30-37

TEXT OF ENGLISH ABSTRACT: Differential thermal analysis, thermo-gravimetric analysis and x-ray semiquantitative analysis have been employed in the study of the effect of MF water reducing agent on the hydration kinetics of portland cement, and scanning electronmicroscope and mercury porosimeter have been used in comparing the structure of cement mortars with or without the addition of MF agent. Results obtained indicate that the increase of mortar strength after introducing MF agent is not due to the acceleration of cement hydration but to the improvement of structure and reduction of total porosity of the mortar, the pore size being diminished and structure becoming denser. Furthermore due to the dispersive action of MF, the mortar structure on the whole becomes more homogeneous. Lastly, in the present investigation no new hydration product has been found by adding MF agent.
This paper was received for publication on 27 Jun 79.

AUTHOR: LIU Genrong [0491 2704 2837]

ORG: Cement Research Division, Academy of Building Materials

TITLE: "Phase Equilibria of Systems Al_2O_3-P_2O_5-H_2O and MgO-P_2O_5-H_2O and Their Application to Phosphate Cement"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 38-53

TEXT OF ENGLISH ABSTRACT: Following a general survey of phaseequilibria of system Al_2O_3-P_2O_5- H_2O and MgO-P_2O_5-H_2O, discussions have been made with respect to the binding process and reaction products of phosphate cement under normal temperature. Interpretations are also presented relevant to processing technology of the cement.
This paper was received for publication on 15 Jan 79.

AUTHOR: ZHU Peinan [6175 1014 0589]

ORG: Shanghai College of Chemical Engineering

TITLE: "Morphological Investigation of the Origin of Stones in Glass"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 54-64

TEXT OF ENGLISH ABSTRACT: It has been shown that the mineralogical compositions of glass stone could be determined by petrographic methods. The difficulty, however, lies in tracing their origins. The author has noted the relationship between microstructure and the conditions of crystal growth. In this paper, the various crystalline shapes are described in relation with the evolution of microstructure of glass stones. It has been shown that the silica modifications as well as other crystalline phases owe their morphologies to the history of crystal growth or to the conditions of their formation. The stones are classified with respect to chemical aspects. The morphological study of the typical microstructures, relevant to the transformation of various silicate phases may contribute to a better understanding of the origin of stones in glass.
This paper was received for publication on 22 Feb 79.

AUTHOR: YAN Dongsheng [0917 2639 3932]

ORG: Shanghai Institute of Silicates, Chinese Academy of Sciences

TITLE: "Account of Progress in the Research of High Temperature Ceramics in West Germany and Italy and Some Other Countries"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 65-79

TEXT OF ENGLISH ABSTRACT: A group of Chinese ceramic scientists attended the 4th CIMTEC Conference held from 28 May to 1 Jun, 79 at Saint Vincent, Italy. The essential theme of this conference was on energy and ceramics. Thereafter they visited a few of the Italian institutes and universities and thence continued a ten-day investigation tour to West Germany in and around Stuttgart. In this report, some of the more important works done in the field of high temperature ceramics will be described. The topics that are included concern high temperature ceramics of the silicon nitride and carbide systems, theory of liquid phase sintering, composite materials, and the mechanism and means of toughening ceramics by phase transformation.
This paper was received for publication on 10 Oct 79.

AUTHOR: WU Qianshang [0702 0051 4545]
CHEN Qinghan [7115 1987 3352]
TIAN Wanchun [3944 8001 2504]

ORG: All of Institute of Physics, Chinese Academy of Sciences

TITLE: "Crystal Growth and Characterisation"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 80-94

TEXT OF ENGLISH ABSTRACT: Imperfections such as cracks, inclusions, growth striations, color centers, inhomogeneity, and cellular structures that frequently occur in artificially grown crystals are discussed. The phenomena of constitutional super-cooling are dealt with in more details. The origins of occurrance of these imperfections and the measures adopted to overcome them are recommended. It is stressed, moreover, that the work on growth of crystals and their characterization must coordinate intimately so that the final goal of obtaining perfect crystals may be attained through successive stages of experimental research.
This paper was received for publication on 2 Jul 79.

AUTHOR: WENG Wensheng [5040 2429 3932]
LI Huizhang [2621 1920 4545]
LIU Jinlong [0491 6855 7893]
YANG Yinlan [2799 6892 5695]

ORG: All of Ultrasonic Laboratory, Institute of Acoustics, Chinese Academy of Sciences

TITLE: "Czochralski Growth of Zinc Niobium ($Zn_3Nb_2O_8$) Single Crystals"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 95-99

TEXT OF ENGLISH ABSTRACT: Large single crystals of zinc niobium ($Zn_3Nb_2O_8$) have been grown by pulling method from a melts. The melting point of the congruent compound has been determined to be 1308°C. The x-ray study showed $Zn_3Nb_2O_8$ to have orthorhombic symmetry with lattice parameters a = 19.048Å, b = 5.901Å, c = 5.194Å. Other determinations made are: density d = 5.731 g/cm^3, elastic constants $C_{11} = 1.35 \times 10^{11}\ N/m^2$, $C_{22} = 1.28 \times 10^{11}\ N/m^2$, $C_{33} = 1.12 \times 10^{11}\ N/m^2$ and dielectric constants $\varepsilon_{11} = 32$, $\varepsilon_{22} = 21$, $\varepsilon_{33} = 16$.
This paper was received for publication on 28 Apr 79.

AUTHOR: YI Liying [0122 7787 3853]

ORG: Institute of Geology, Chinese Academy of Sciences

TITLE: "Determination of Ferrous Iron in Minerals and Silicate Rocks by Spectrophotometry"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 100-104

ABSTRACT: A simple and fast spectrophotometic technique of determining ferrous iron in minerals is formulated. Milligram specimens are taken and weighed to be placed in hard polyvinyl or polypropyrene bottles. When heated hydrofluoric acid and sulfuric acid mixture is used to seal and dissolve the specimen, pure silicon dioxide power is added to cause the specimen to decompose quickly and to prevent aerobic oxidisation of ferrous iron so that a high precision of determination may be obtained. In an acetate medium of pH 4-6, spectrophotometric determination proceeds using a stable complex produced by ferrous iron and o-ferroin. This method has been employed for the determination of ferrous oxides in various different mineral rocks, with relatively satisfactory results.

AUTHOR: HUANG Dequn [7806 1795 3028]
JIN Jiren [6855 0679 0086]
CHEN Jiaping [7115 1367 1627]

ORG: None

TITLE: "National Scientific Conference on Crystal Growth and Materials Held in Suzhou"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 pp 105-106

ABSTRACT: A National Scientific Conference on Crystal Growth and Materials, sponsored by China Society of Silicates' Committee on Crystal Growth and Materials was held in Suzhou City 21-28 Nov [79]. A total of 180 delegates and 29 alternates representing 107 organizations of the 25 provinces, cities, and autonomous regions of the country attended. Sixty scientists, technicians, and management persons were also among the audience. The invited delegates covered fields of construction materials, metallurgy, geology, chemical engineering, First, Second, Theird, Fourth, Fifth, Sixth, Seventh, and Eighth Ministry of Machinery, Chinese Academy of Sciences, schools of higher education, experimental and production units, publishers, and motion picture manufacturers, etc. The conference received 265 papers,which were compiled into 3 volumes of abstracts. In conjunction with the preparation for the Conference of Cystallography, the Library of Chinese Academy of Sciences compiled Catalog of Literature in the Library Concerning Crystal Growth. This has been the first large scale conference on the subject since 1974.

AUTHOR: None

ORG: None

TITLE: "A Scientific Exchange Conference on Microstructure Held Jointly by China Chemical Society, China Society of Metals, and China Society of Silicates"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 p 106

ABSTRACT: China Chemical Society, China Society of Metals, and China Society of Silicates held a Joint Conference of Scientific Exchange on Microstructure in Kunming City, 7-12 Dec 79. Participants included 46 scientists representing 24 organizations. A total of 39 papers were received, twenty of these on metal materials, eleven on inorganic metal materials, and eight on high molecular materials. It was the consensus of the conferees, following much exchange of ideas, that although the concrete objects of research are obviously different in metals, inorganic materials, and high polymers, the 3 fields have a common objective, i.e. to search for suitable materials for applications. There are also many common grounds in terms of interrelationship among the microstructure, the property, and the experimental procedures. Much, therefore, can be gained by connecting the 3 types of materials to overcome the weakness of scientific isolation. All delegates enthusiasically endorsed conferences of this sort in the future.

AUTHOR: ZHANG Lehui [1728 2867 3055-1920]

ORG: None

TITLE: "Delegation of China Society of Silicates Participated in the Second European Conference on Crystal Growth (ECCG-2)"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 p 107

ABSTRACT: The Second European Conference on Crystal Growth was held 10-15 Sep 79 in Lancaster, England. Participants included 270 delegates representing 20 nations. The Chinese delegation was composed of ZHANG Shouqing [1728 4849 1987] of Shanghai Institute of Silicates, Chinese Academy of Sciences, HOU Chaoyang [0230 2600 7122] of the same organization, ZHANG Lehui, the author of this report, of Institute of Physics, Chinese Academy of Sciences, and FAN Chunxue [5400 4783 1331] of Institute of Artificial Crystals, Ministry of Construction Materials, and ZHANG Kecong [1728 0344 1783] of Shandong University. The delegation presented 4 papers to the conference. Major subjects of discussion and exchange at the conference are briefly reported. Following the conference, the Chinese delegation visited universities, research institutes, and factories. The delegates stayed in England for more than 2 weeks. Aside from gains in scientific knowledge, they also established friendship and rapport with foreign scientists.

AUTHOR: None

ORG: None

TITLE: China Society of Silicates Construction Material Specialty Committee Officially Established and a Scientific Conference Held"

SOURCE: Beijing GUISUANYAN XUEBAO [JOURNAL OF SILICATES] in Chinese Vol 8 No 1, Mar 80 p 108

ABSTRACT: From 12-19 Dec 79, the State's Science Committee called a meeting for exchanging experience concerning new construction materials and experimental construction techniques. A total of 331 delegates represented scientific committees and construction committees of the various provinces, cities, and autonomous regions of the country, as well as scientists and engineers of construction engineering, construction materials, chemical engineering, etc. China Society of Silicates was active at the meeting. The Vice-president of the society, XU Zhuoran [1776 0587 3544] announced the official establishment of the Construction Material Specialty Committee and read the names of those designated as committee members. The first work conference of the committee was immediately called, chaired by the committee chairman QU Tongxin [2575 6639 7451]. Inspite of the title of this paper, the contents deal primarily with the experience exchange conference called by the State's Science Committee. The establishmdnt of the Construction Material Specialty Committee by China Society of Silicates is only casually mentioned.

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